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OXFORD GASWORKS

LORD LEATHERS Secretary for the Co-Ordination of Transport, Fuel, and Power, announced in the House of Lords on Thursday that the Southern Gas Board had decided not to appeal against the refusal of the Oxford City Council to give planning permission for extensions to the existing gasworks at Oxford, and added, 'The scheme has therefore lapsed.' That, however, is not the end of the story; it is only the end of another episode in a lengthy serial, the next instalment of which will be awaited with interest, not least by those whose gas requirements the Board is already unable to meet. Meanwhile the ability of the undertaking, even with the assistance of a supply now being piped from Reading, to cope with growing demand is deteriorating and unless a satisfactory solution to the problem of closing the gap between supply and demand is soon found the position will become critical. We need not here recount the history of the undertaking since the former Oxford and District Gas Company nearly four years ago submitted its proposals for extensions to a memorable public enquiry, as a result of which the Ministries concerned gave approval—a decision ultimately reversed on appeal to the House of Lords. Negotiations for alternative sites were opened and a little over a year ago the Planning Committee was so far satisfied with the progress then being made that in a report to the City Council it referred to an 'arrangement' whereby the Southern Gas Board was to build a new works on a site at Cowley to clear the north bank of the river within six or seven years, and, as a long term project of 25 years or so, to remove the remainder of the works from the centre of the city without payment of compensation additional to that to which the Council was already committed in respect of a gasholder.

Last December Mr. Owen R. Guard, Chairman of the Board, told a Press conference that the need for additional gas-making plant was growing in urgency to such an extent that the Board had felt compelled to proceed with extensions—modified and modernised to some extent from those proposed in 1948—adjoining the present works. In due course the scheme was submitted to the Planning Committee, on whose recommendation the City Council refused to grant planning permission. The Board could have appealed from that decision to the responsible Ministries, and perhaps would have done so but for the intervention of Lord Leathers. The whole matter seems to have resolved itself into a fight between beauty and utility, and in the latest round the advocates of beauty have won; consequently a resolution regretting that the Board should attempt to revive the scheme, which had been tabled in the Lords by the Earl of Halifax for Thursday, was dropped.

The Gas Board is still faced with its statutory obligation to 'satisfy . . . . all reasonable demands for gas,' and in a letter to the Town Clerk of Oxford announcing the Board's decision Mr. T. E. D. Mason, Secretary of the Board, has 'placed on record various points' so that 'there shall be no misunderstanding.' These include the warning that the Board cannot accept responsibility for any shortage of gas which may result from the refusal of planning permission and calls attention to the fact that any resulting failure of gas supplies would be due to circumstances not within its control. Every effort will be made to maintain an adequate supply, but figures prepared in October, 1951, disclosed that a serious position must be faced. The emergency measures now being taken will add to the cost of gas, the letter adds. Cuts in steel and capital allocations will undoubtedly delay the completion of any specific projects for a number of years, so that the Board cannot give any definite undertaking as to the removal of the existing works nor 'consider itself bound by any previous undertakings dealing with the matter.' The Town Clerk has pointed out that the position now is the same as that in 1949 when the Gas Board superseded the Oxford and District Gas Company. It is expected that the City Council will re-open negotiations with the Board on the question of the ultimate removal

of the gasworks. Commenting on the statement in the Board's letter that it is 'not now in a position to give any definite undertaking as to the removal of the works, nor can it consider itself bound by previous undertakings dealing with this matter,' Mr. A. B. Brown, Chairman of the Planning Committee, has stated that he sees no reason whatever in present circumstances for the Board to withdraw its undertaking.

CORROSION

SEVENTY or eighty years ago the Iron Age gave way to the age of mild steel. This seems now to be giving way to the age of the alloys. Cast iron is protected by its heavy scale and even wrought iron was not so rapidly destroyed by rusting as its successor mild steel. The immense quantity of this material now embodied in the more permanent structures of modern civilisation has made the problem of its protection against corrosion one of immense importance. Dr. Arthur Marsden, in his paper to the South Western Section of the Institution of Gas Engineers (*Journal* of February 13, p. 413), brought his analytical mind to a survey of a very wide field, necessarily no more than summarising the main points.

The modern view of corrosion is that it is essentially an electro-chemical phenomenon. The main problem is the protection of iron, or rather mild steel which in course of manufacture becomes coated with mill-scale, the magnetic oxide of iron, Fe_3O_4. It might be expected that this would form a sufficient protection, as effective as the 'skin' of the casting. Possibly it would if it could be kept intact; unfortunately in handling and fabrication it becomes broken and then serious corrosion takes place where it is cracked or flaked away. Pitting or corrosion which then occurs is explained by the fact that the oxide has a more positive electrode potential than the iron itself; 'mill-scale is cathodic to iron' and thus gives rise to localised corrosion where both are exposed.

The amount of money spent annually on protective schemes for ferrous structures is prodigious, and yet the damage by rust still gives rise to grave concern. Protection by painting represents by far the major part of this great expenditure. Dr. Marsden opened this section of his paper by pointing to bad design of steel structures which is too often to blame for rust attack. Gusset plates, joints, and fastenings of all kinds should be designed to obviate the possibility of lodgements of water and dirt in the finished structure. In fabrication, too, faces which are to be concealed should be given at least the primary coat of paint before the connection is riveted or bolted up.

Every year in this country alone some 400 million gallons of paint is used on iron and steel and *much of it is wasted* due to inadequate preparation of surfaces or its application under unsuitable conditions. Dr. Marsden suggests that one half to two-thirds of the cost of painting a steel structure should be expended in the preparation of the surface. It is obvious that the surface should be dry and clean before paint is applied. The removable mill scale is likely to be troublesome; chipping and wire-brushing can be expensive in labour costs. Complete weathering is not always possible. Sand blasting, acid pickling, and phosphating are mentioned. The last named was dealt with fully by M. A. Marty, of the Research Department of Gaz de France, in a lengthy survey in the *Journal des Usines à Gaz* which was briefly abstracted in our issue of February 8, 1950, p. 532. The surface of the metal to be painted is first brushed down and then washed with a carefully selected concentration of phosphoric acid. The object is to form a layer of microscopic crystals of phosphate of iron between the metal and the layer of paint. It has been observed that paints applied with this treatment have a quite exceptionally long life. The new technique of flame cleaning appears to be very effective, but applied to existing structures, such as a gasholder, there is risk of destroying caulking tape in the joints.

PAINT AND PAINTING

THE technique of paints and painting appears to be governed largely by tradition. Red lead has proved to be the standard for the primary coat without anyone quite knowing why. We turn again to M. Marty for an alternative. He describes the use of pitch-base paints (*Journal* of September 22, p. 634). In France the acute shortage of linseed oil after 1940 compelled engineers to reconsider the developments of paints with a pitch basis, and very soon a product which at first was merely a substitute began to reveal properties and advantages of its own. Tens of thousands of tons of iron and thousands of machines are now protected by pitch-base paints. The protective film is carried in a solvent which evaporates leaving a covering more or less hard, resistant, and more or less plastic. Pitch base paints are not normally used over a primer and they are not intended to be covered with a protective varnish. In general they are self-sufficient. M. Marty's remark on the value of such a development as this in times of national economic difficulty 'as yet another example of the use of the derivatives of indigenous coal, saving the importation of external raw materials,' would seem to recommend it to our own engineers in this our own time of national economic difficulty. But whatever the primer or paint used, in one or more coats, it remains true that the efficacy of the first coat is largely dependent (one would have thought entirely dependent) upon its intimate contact with and adherence to the surface of the metal—without any water, grease, or dirt in between. The results of the investigation which Dr. Marsden has in hand of various systems of painting will be awaited with interest.

The subject of the cause and prevention of corrosion is immense, and the chief value of his paper will lie in stimulating thought and pointing the way to further investigation and to particular solutions to particular problems. Before leaving the wide subject of the big scale structure, buildings, bridges, etc., one is tempted to remark upon two points—first the amazing success, in spite of the risks of corrosion, of the brick and stone covered steel building which is so characteristic

a feature of our modern cities, and secondly the possibilities of ferro-concrete in exposed structures which would seem to be a complete solution of the atmospheric corrosion problem.

The paper is full of interesting side issues, springing as it were spontaneously from Dr. Marsden's well stocked mind. This is the limitation of waste heat recovery by the dew-point of sulphuric acid. A corollary of this is the unwisdom of underrating the waste heat boiler. Who has not seen the case of the waste heat boiler too big for its job where the temperature of the exit gases is brought down too low with the consequent rapid corrosion of the sheeting of exit flues? The technique of metallisation promises to be applicable in the other side of metal protection, that of mechanical parts and plant in contact with the corrosive liquids and gases of the gas making and purifying processes. Some of the processes listed by Dr. Marsden are protective against wear rather than corrosion (*e.g.*, the nitralloy process), others against heat (*e.g.*, calorising), but all are useful in their place.

We began our note with the coming of the alloys. Apart from what may be called the 'high' alloys with chromium and nickel which are so expensive as to confine them to special jobs of no great size, the copper-bearing steels have been applied in some bigger structures. Their use in the conveyor bucket, so liable to corrosion from the liquors associated with wet coal and coke, has been effective at comparatively low cost. The suggestion that copper-bearing steel should be used for rivets, and the reason why, merits the attention of the structural engineer.

The subject of underground corrosion of pipes and mains is too immense for cursory comment. The very lively discussion showed that it was not far from the minds of those present. We should award the palm of originality to Mr. H. H. Brown, of Exeter, who described how he destroyed the anærobic bacteria of the gasholder water by pumping it over the top of the holder in the sunshine—and the sunshine killed the bacteria.

GAS SERVICE CONFERENCE

ALL the signs are that next month's Gas Service Conference in London (March 11, 12, and 13) will prove a very great success. It was, of course, unfortunate that, as explained in last week's *Journal*, certain modifications had to be made in the social arrangements originally planned. But, apart from this, the programme, with its wealth of variety of topics to be discussed, remains unimpaired. The event, which has full backing and encouragement at high level, will, we are sure, be counted among the highlights of the gas industry's year. Throughout the country there is evidence of great enthusiasm among the many engaged on the service side of our industry, and this is all to the good. Two thousand two hundred have registered for this three-day meeting to be held in the Seymour Hall, and the excellent planning of the occasion, with organisation to the smallest detail, will ensure smooth running and will make certain that the maximum benefit will be derived from the various sessions. Those on the service side will have good reason to feel that their work is recognised and valued, as indeed it should be.

TAXPAYERS AND THE BUDGET

REALISING that in present circumstances no appreciable relief from the burden of taxation can be expected, the Income-Tax Payers' Society this year confines the Budget memorandum which it submits annually to the Chancellor of the Exchequer to three matters affecting individual taxpayers particularly which in its opinion call urgently for some readjustment. First, on behalf of elderly people with fixed incomes who are finding life increasingly difficult it is urged that the rate of 'age relief' should be increased, as well as limit of income to which it applies. Secondly, in view of the need for maximum productive effort, the Society hopes for some further 'earned income' relief by way of removal of the present £400 limit. Thirdly, where taxpayers over 65 have failed to claim post-war credits before death it is suggested that instead of payment becoming dependent on the age of beneficiaries, executors should be able to claim payment so that the estate may have immediate benefit. While endorsing the suggestions of the F.B.I. and other bodies regarding profits tax and excess profits tax, the Society emphasises that as soon as the economic situation warrants it the first major relief to be considered should be a reduction in the standard rate of tax.

INDUSTRIAL WALES

FOUR years ago, when gas was still in company and municipal hands and electricity had just been nationalised, the Industrial Association of Wales and Monmouthshire published its first *Industrial Directory of Wales and Monmouthshire*. There have been many changes since 1948 and a second edition of the *Directory* just out brings the picture of industrial Wales up to date and contains information concerning the many industries which have been established in the area in the intervening period. The Association's objects are to foster trade and industry for Wales and Monmouthshire, to attract trade and industry thereto, to unite the industrial resources of the area, and to help to secure a continued and expanding prosperity for the area. Besides giving complete lists of industries, whether in membership of the Association or not, the *Directory* contains editorial features contributed by the heads of the principal industries—features which provide an authentic record of development with indications of prospects and problems to be considered. The Wales Gas Board is a member of the Association, and Alderman G. F. Hamer, Chairman of the Gas Consultative Council, is a member of the Council —not as an official representative of the gas industry but as head of the leather manufacturing firm of T. Price Hamer, Ltd. Among the 18 industrial reviews we are especially interested in that by Mr. T. Mervyn Jones, Chairman of the Wales Gas Board, which deals with the rapidly expanding industrial use of gas and the steps taken by the Board to meet the demand. Special reference is made to the two South Wales gas grids linked with large coke oven plants and the progress now being made with the interlinking of the North Wales coastal undertakings. Emphasis is laid on the free service provided at the Board's industrial gas centre at Bute Terrace, Cardiff, but Mr. Mervyn Jones does not overlook the fact that improvement in supply and service to the domestic consumer is also continually under consideration. 'A complete service,' he writes, 'is made available to all domestic, commercial, and industrial consumers on the correct use of gas, this latter point being of vital importance in conserving the nation's heritage—coal.'

Letters to the Editor

THE 'R' RATIO

DEAR SIR,—I have read with interest the letter published in the *Gas Journal* of February 20 from R. J. S. Thompson discussing the 'R' ratio.

I should like, if I may, to attempt to clarify the use of this measurement. For some years prior to 1930 I was collecting data from many gas undertakings with a view to comparing the conditions particularly affecting purification, and it became apparent that the introduction of a simple comparative figure for the capacity of purifiers was desirable and that this figure should be expressed in terms of measurements commonly employed at gasworks.

Its use was first suggested in a paper published by Clayton, Williams, and Avery and presented to the Manchester District Association of Gas Engineers in October, 1931. At this time few sets of purifiers had more than four rotating or working boxes and the 'R' number was consequently used for comparison of sets of four boxes. It is, in fact, independent of the number of working boxes in a set and can be applied equally well to sets of four, five, or six boxes.

I cannot agree with Mr. Thompson's statement that it must be accompanied by a statement of the number of boxes to give a comparative figure, although such a statement does present a more complete picture of the purification system.

In suggesting the use of this measurement it was clearly stated that the 'R' figure was the cubic feet of gas per hour purified divided by the number of cubic feet of oxide in one box, or, in other words, the number of cubic feet of gas passing through each cubic foot of oxide per hour.

Obviously such a figure must be used within certain limits, and although these limits are quite wide they cannot be indefinitely extended. Use of this measurement has been applied to figures ranging from 6-60 and the performance between this range is approximately that anticipated.

Mr. Thompson's suggestion that the figure should be replaced by the use of a time measurement expressed in seconds does not seem to represent any very substantial diffrence, but merely adds the further step of dividing the calculated 'R' ratio into 3,600.

I still feel, therefore, that an expression in terms of cubic feet of gas and cubic feet of oxide per hour cannot be greatly simplified.

Yours faithfully,

H. B. AVERY.

Hardman & Holden, Ltd.,
Manox House, Miles Platting,
Manchester, 10.

February 21, 1952.

DEAR SIR,—I have no wish to distract attention from the technical part of Mr. Thompson's argument (*Journal* of February 20, p. 463) but I should like to raise a point of terminology.

In stating the time for which gas is in contact with oxide (or scrubbing liquid or catalyst) we often speak of 'time contact' when we mean 'time of contact' or 'contact time.' These descriptions are already in common use and are to be preferred grammaatically, and speakers and writers might like to consider using them.

Yours faithfully,

R. F. TWIST.

20, Westbrook Road,
Blackheath, S.E.13.

February 23, 1952.

Personal

Mr. Sydney Smith has been appointed by the Minister of Fuel and Power to succeed Mr. H. F. H. Jones (who became Deputy Chairman of the Gas Council early this month) as Chairman of the East Midlands Gas Board. Mr. Smith, who has been Deputy Chairman of the Board since its inception in 1948, was formerly General Manager and Engineer of the Romford Gas Company, a position to which he was appointed in the autumn of 1945. A native of Bradford, he served in the Bradford Gas Department and also at Birkenhead, Dunfermline, and Bristol, before being appointed Engineer and Manager of the Paisley Gas Department in 1939. While at Paisley he took an active part in the work of the Scottish Management Committees of the National Gas Council, the British Commercial Gas Association, the Federation of Gas Employers, and the Regional Council of the National J.I.C.

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Sir John Green, who has been deputy-chairman of the Iron and Steel Corporation since its inception in 1950, has been appointed chairman of the Corporation in succession to Mr S. J. L. Hardie who resigned last week. Sir John is a part-time member of the East Midlands Gas Board and until he joined the Corporation he was a director of Thomas Firth and John Brown and of Firth Brown Tools.

Diary

Feb. 28.—Society of Chemical Industry (Yorkshire Section): Joint meeting with Leeds University Chemical Engineering Society: Hodsman Memorial Lecture, A. C. Monkhouse, B.SC., PH.D., F.R.I.C.

Feb. 28.—North Thames G.C.C.: Westminster City Hall, Charing Cross Road, 2.30 p.m.

Feb. 28.—Eastern Section, I.G.E.: Discussion on Report of Institution of Gas Engineers' Sub-Committee on Unaccounted-for Gas, introduced by Lieut.-Col. J. A. Gould, M.C., M.I.MECH.E., M.INST.GAS E. Town Hall, Peterborough, 2.30 p.m.

Mar. 1.—Midland Juniors: Annual Dinner, Imperial Hotel, Birmingham.

Mar. 3-29.—Ideal Home Exhibition, Olympia. Gas Council stand No. 67, Grand Hall.

Mar. 4.—South Eastern G.C.C.: Caxton Hall (Kent Room), Westminster. 2.15 p.m.

Mar. 4.—Midland Juniors: 'An Introduction to Combustion Safeguard Equipment,' J. Price (Coventry). At Birmingham.

Mar. 4.—East Midlands G.C.C.: Victoria Station Hotel, Nottingham, 11.30 a.m.

Mar. 5.—Southern G.C.C.: Social Welfare Club Room, Reading Gasworks, 2 p.m.

Mar. 7.—London and Southern Juniors: 'Twenty Years of Development in West Kent,' F. T. Buist (South Eastern). 178, Edgware Road, 6.30 p.m.

Mar. 8.—Scottish Juniors: Joint meeting of Eastern and Western Districts; paper by J. T. Haynes, Junior Vice-President, Institution of Gas Engineers. Glasgow, 3 p.m.

Mar. 11-13.—Gas Service Conference. Seymour Hall, W.1. (For full programme see *Journal* of Feb. 20, p. 469.)

Mar. 12.—London and Southern Juniors: Visit to Lewis Berger works, Homerton. 2 p.m.

Mar. 12.—Yorkshire Juniors: President's Day. Visit to Drakes, Ltd., Halifax.

Mar. 12.—South Western G.C.C.: 34, Bridge Street, Taunton, 11 a.m.

News in Brief

The Republic of Ireland imported 22,977 cwt. of gas heaters, cookers and parts in 1951, valued at £246,967 as against 23,706, valued at £258,372 in 1950.

Visit to Crewe.—The Chairman of the North Western Gas Board, Mr. D. P. Welman, and members of the Board visited the gasworks at Crewe, on February 13, to inspect the works and to meet officials of the Railway Executive from which the Board recently purchased the Crewe undertaking at a cost of £250,000.

The Trade Statistics for November, 1951, issued by the Central Statistics Office in the Republic of Ireland, show imports of 21,599 tons of gas coal, valued at £131,137, as against 17,877 tons, valued at £86,510 in November, 1950. This brings the total of these imports for the first eleven months of 1951 to 250,389 tons, valued at £1,305,473, compared with 226,454 tons, valued at £1,042,202 in the corresponding period of 1950.

A Series of Six Talks on the practical approach to storage water heating was given at the invitation of the North Eastern Gas Board on February 5, 6, and 7, to the Huddersfield/Halifax Group by Mr. M. H. Thornton, Water Heater Sales Manager, Radiation Group Sales, Ltd., and Mr. H. W. P. Shewring, Radiation Technical Service. A similar talk was given on February 12 by Mr. Thornton and Mr. A. St. Leger, Radiation Hot Water Engineer, to the West Surrey sales discussion group of the South Eastern Gas Board. The talk was given at the invitation of Mr. F. A. Cheeseman, Divisional Sales and Service Manager.

New Fylde Gas Link Opened

A SECTION of gas main linking Blackpool and Fleetwood, 4½ miles in length, laid by the North Western Gas Board's Fylde group at a cost of £42,000, has been officially opened. The Mayor of Fleetwood, Councillor E. A. Lawrence, J.P., performed the opening ceremony at a new control chamber in the grounds of Rossall School.

At a luncheon held to mark the opening of the new link, which forms part of the Fylde group's scheme for the total integration of its undertakings, Mr. J. G. O. Drake, Group General Manager, said that the Board was producing gas more efficiently than ever before. At Blackpool's Marton works, for example, using the plant taken over on vesting date, they had in 1951 not only produced more gas but saved £85,000 in the process. This saving represented 2d. per therm on gas sold during the period to all Blackpool consumers.

As an example of what was being done to improve efficiency by adding new plant, Mr. Drake cited the Fleetwood-Thornton-Poulton-Blackpool interlinkage scheme. It had been calculated he said, that the 20 years' planned development in Fleetwood and Thornton alone would require an additional 200 mill cu.ft. of gas per annum for new housing, apart from normal increases in the existing load.

'The gasworks in these districts would have been quite unable to meet such an increase without a major reconstruction scheme involving considerable capital and renewal expenditure,' said Mr. Drake. 'The alternative, an interlinkage main with Blackpool, proved to be the cheaper in the long run, and events have shown this preference to be wise from every point of view.'

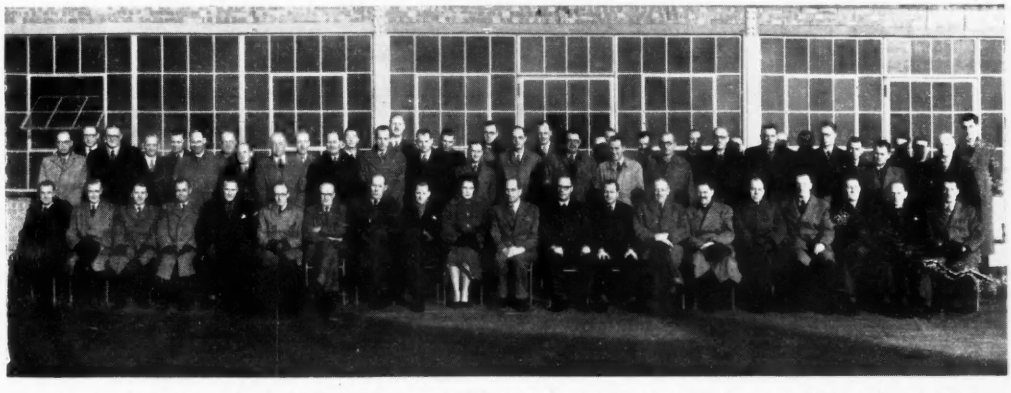
Apart from the lower initial capital expenditure, a scheme of that kind enabled the Board to improve pressures, guarantee continuity of supply and reduce the average cost of gas by drawing some supplies from Blackpool (the cheapest production unit in the group) to meet peak demands in Fleetwood and Thornton-Cleveleys.

Further economies would arise because both Fleetwood and Thornton would operate their plant to the maximum capacity, day in and day out. For the next few years, therefore, the Board had no intention of closing down either Fleetwood or Thornton works, whatever its future intentions might be. Old plant was better than none at all and while the gas industry continued to receive allocations of new capital powers far below its known legitimate requirements to meet essential developments, they must inevitably 'make do and mend.'

It Was Reported to the Bradford Corporation Finance and General Purposes Committee on February 12 that the North Eastern Gas Board is increasing the price of gas for street lighting from 9d. to 10d. a therm, between April 1 and the end of March, 1953. The reason given by the Board is the continued rise in the cost of coal and manufacturing charges. The Board has also reported that preliminary discussions are taking place with lighting authorities to develop a new formula for calculating the charge to be made.

A Further Request was made at the last meeting of Limerick Harbour Commission by the city Gas Manager for a site for a coal depôt on the quay side. A previous request had not been considered. It was pointed out that coal which had to be carted from the quay added to the cost of gas on the local gasworks and that a depôt on the quayside would materially assist in keeping down the cost of gas. The matter was referred to a sub-committee. The demand for gas used in Limerick industries is on the increase.

GAS WATER HEATER PRODUCTION



The sales and service staff of the West Surrey Division of the South Eastern Gas Board recently made three visits to the North Circular Road works of Ascot Gas Water Heaters, Ltd., where they were shown the various stages of gas water heater production. The parties were interested in the Balanced Flue Multipoint. The tours were arranged by Mr. F. A. Cheeseman, Sales and Service Manager of the Division, in conjunction with Mr. G. N. Behr, Ascot's London Manager. In our illustration Mr. Behr is seen seated in the centre of the front row with Mr. Cheeseman on his left.

GAS IN INDUSTRY EXHIBITION

THERE was a large company of leading West country industrialists and civic heads when a 'Gas Industry' Exhibition staged by the South Western Gas Board in the Romney Hut, Raglan Barracks, Plymouth, was opened on February 12 by the Lord Mayor of Plymouth, Alderman Randolph Baker. Among those present were Mr. Colin Campbell (Town Clerk of Plymouth), Mr. J. Paton Watson (City Engineer, Plymouth), Mr. H. B. Trewhella (Mayor of Truro), Surg. Com. J. L. Lean (Deputy Mayor of Falmouth), Alderman H. E. Wright, Mr. F. G. Fleury (Chairman, Port of Plymouth Incorporated Chamber of Commerce), Mr. P. R. Scutt (Managing Director, Tecalemit, Ltd.), and representatives of H.M. Dockyard, the South Western Electricity Board, War Department, Devonport Mercantile Association, and South Western Tar Distilleries.

Mr. C. H. Chester, C.B.E., Chairman of the South Western Gas Board, who presided, said gas was playing an increasingly large part in raising productivity and in preventing wastage, particularly in the rearmament drive. He stated that the industrial demand for gas throughout the country was growing enormously, no doubt owing to its unfailing supply, flexibility, and ease of control. Following liaison with other gas boards and centralised research the applications of town gas were widening every month. Many thousands of industrial concerns throughout the country were using gas driven machinery, and Mr. Chester mentioned as an illustration the fact that the Austin Motor Company's works at Longbridge, Birmingham, alone used more gas for the infra-red drying of painted car bodies than the whole of the city of Plymouth.

Great Demand for Gas

The Lord Mayor said he could well understand that there was a great demand for gas in industry, and he emphasised the need for constant quality in industries where the determination of temperatures was essential. He could see no reason why the use of gas should not increase, since it was a fuel which was easy to handle. Turning to local affairs the Lord Mayor said the local industrialists were collaborating in the task of reconstruction and were as keen on the work as was the City Council.

The Lord Mayor and the other visitors to the exhibition were conducted round by Mr. Chester, Mr. T. H. Pardoe, Area Industrial Gas Officer, and other officials of the Board, and shown a great variety of exhibits. Many companies in the area had loaned apparatus to make up the exhibition.

The show is the first of its kind organised by the Board in its Southern Division, and the Plymouth and North Cornwall sub-division was responsible for installing the plant used. This included an example of an infra-red paint dryer such as is being used by an Exeter firm for the drying of paint on plastic fabrics and in poster and advertisement work. The visitors were also interested in a new development of a ladle heater, designed to speed up the handling of molten metals in foundry work. Also included were a natural draught furnace for heat treatment of springs, designed to give the highest possible efficiency at an economic rate, and a steam boiler equipped to drive ventilating fans, which is thermostatically controlled and fitted with an alarm to indicate low water level. Other industrial applications of gas on exhibition were concentrated combustion and flame hardening.

The industrial use of gas in the Southern Division, which is largely a residential and agricultural area, has hitherto been limited. The Board feels that the area, with expanding industrial pockets at Plymouth, Exeter, Taunton, Falmouth, and Camborne-Redruth, presents a wide field of potential industrial consumers, and the exhibition was designed to interest both the large and the smaller manufacturers. One interesting exhibit was related to the use of gas in pottery drying, the finished products on view attracting considerable attention.

It was originally intended to have a series of Controlled Flame boilers set up in connection with the bakery exhibit, but owing to a regulation of the Bakers' Federation prohibiting collaboration in an exhibition of this kind the only firm (outside the Federation ring) taking part were the manufacturers of the Spooner oven. The tie-up in utilisation of Controlled Flame boilers was mainly with overhead steam heaters, one of which was demonstrated at the exhibition.

Mr. C. H. Chester, C.B.E., Chairman of the South Western Gas Board, speaking at the opening of the exhibition. Also in the group are the Lord Mayor of Plymouth (Alderman R. Baker) and on the right the Town Clerk (Mr. Colin Campbell).

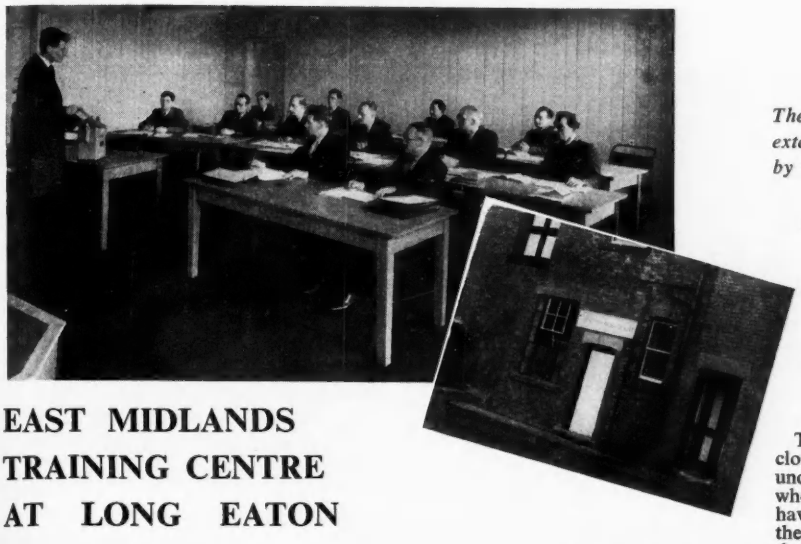
Llanelly Branch W.G.F.

The inaugural meeting of the Llanelly branch of the Women's Gas Federation was held in the demonstration room of the Llanelly undertaking on February 6 when, in the unavoidable absence of Mr. A. Pickard (Engineer, Manager, and Secretary) the members were welcomed by Mr. T. D. Barker (Distribution Superintendent). It was announced that the following officers had been appointed: Chairman, Mrs. D. Lewis; Vice-Chairman, Mrs. A. Williams; Treasurer, Miss J. Thomas; Secretary, Miss E. Rudall.

Miss D. W. Pidsley, Headquarters Secretary of the Federation, outlined the policy and objects of the Federation and said that the Llanelly branch was off to a good start with the happy and encouraging position of having 55 paid-up members. It was the second branch to be formed in Wales, the first having been Cardiff.

A vote of thanks to Miss Pidsley was proposed by Mrs. A. Williams and seconded by Miss I. M. Jones, Home Service Adviser to the Swansea group, and the meeting was followed by tea. News having been received earlier in the day of the death of the King, two minutes' silence was observed and a film show scheduled to follow Miss Pidsley's address was postponed.

James Stott & Co. (Engineers), Ltd., Oldham, manufacturers of large-scale catering equipment, have opened a new depot at 14, John Street, Bristol (Tel.: Bristol 24908). This is under the management of Mr. A. W. Teall who has been with Stotts since 1925. The new depot will provide closer supervision and improved consultation and service in the west country from Portsmouth and the Isle of Wight westwards and in South Wales.



The main lecture room and the new exterior of the training centre established by the East Midlands Gas Board at the Long Eaton undertaking.

Blocks by courtesy of the Editor of 'Emgas'

EAST MIDLANDS TRAINING CENTRE AT LONG EATON

CONVERTED premises at the Long Eaton undertaking, comprising lecture rooms and a practical training workshop, house the training centre which, as mentioned in the *Journal* of February 13 (p. 406) has been established by the East Midlands Gas Board to provide, for various classes of employees, specialised training courses which cannot be obtained at technical colleges in the area. The aim is to improve consumer service by standardising working practices and techniques.

Initially training courses for district representatives will be a priority at the centre, but it is intended eventually to conduct various types of courses including the training of district personnel, showroom attendants, district foremen and clerical employees concerned with district work; training in standard methods and practices for selected gasfitters; refresher courses for home service advisers and gasfitters; short courses for administrative and clerical employees; and specialist lectures for various classes of technical staff to cover works and distribution practice.

The large and well lighted practical training workshop on the ground floor is equipped with domestic gas and coke appliances and special units demonstrating central heating and hot water supply installations. The central heating unit consists of one No. 1 series, 5-section Potterton 'Rex' boiler with a heat output of 165,000 B.Th.U. per hour. The hot water supply unit is a size No. 1/2 Potterton 'Emperor' lagged storage set of 34 gal. capacity with a hot water output of 29,600 B.Th.U. per hour, so arranged that the cold feed system, hot storage, boiler, and all pipes and controls are visible for instruction purposes. Recently completed is a brick setting into which has been built a balanced flue Ascot water heater, a balanced flue space heater and a Silent Beam panel fire.

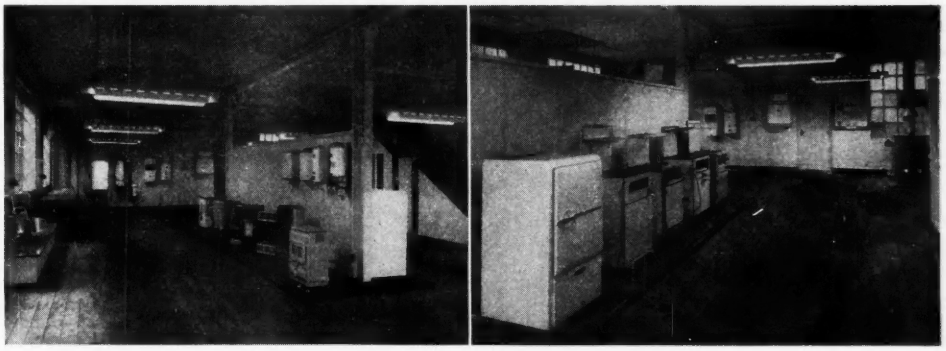
Two Luminous Panel overhead heaters have been fitted above the main bench in the workshop. These provide adequate warmth so that any intermittent instruction in the workshop can be comfortably carried out without the main central heating circuit being in operation. At all significant points the appropriate British Standard identifications appear on the pipe lines, these being explained on a wall chart. The Board's standard district tool kits are available for inspection and instruction.

The two lecture rooms are situated above the workshop on the first floor. Each has accommodation for 15 trainees and a third large room is available for future development. In addition there is a well equipped cloakroom on the ground floor.

The first course is now nearing its close. Twelve employees have been undergoing instruction since January 7 when the course opened. The members have expressed their interest in the work they have done and their enjoyment of the informal conditions under which they studied. On completing their training at the centre all the students who are training to become district representatives will complete two further sections of training. These consist of six weeks training on the district, after which the trainee returns to the training centre for a final passing out test; followed by ten weeks probationary service on the district as an acting district representative.

During the course the trainees have received instruction on mains and services, meters, internal installations, cookers, space heating, refrigerators, water heating, home laundry appliances, clerical procedure, and T.W.I. job relations. They have paid visits to the establishments of appliance manufacturers and their outings have included visits to the factories of the Parkinson Stove Co., Ltd., and Radiation Ltd., Birmingham, and Begwaco Meters, Manchester.

Some instruction has been given by visiting lecturers from the manufacturers who have been able to draw attention to particular points concerning servicing of their appliances and equipment which are sold by the Board and other lectures have been given by members of the Board. The bulk of the instruction, however, has been given by the Chief Instructor, Mr. P. J. Bunker, the centre as a whole being under the control of the Industrial Relations Department at headquarters.



The two sides of the spacious workshop, which is divided by a central partition with various appliances on either side. The stairs seen on the right of the left-hand picture lead up to the lecture room and office.

MORE GAS FOR WIGAN

TO commemorate the building of a new retort house at the Wigan undertaking of the North Western Gas Board, the Mayor of Wigan unveiled a plaque at the works on February 8. Built from 2½ mill. bricks and more than 3,000 tons of steel, the new retort house, which consists of three benches of 16 retorts, has added 4½ mill. cu.ft. per day to the Wigan gas supply. This figure can be increased to 6 mill. cu.ft. per day when necessary. The retort house was started by the Wigan Corporation Gas Committee in 1947, when Mr. Thomas Haworth, now Bolton Group General Manager, was the Engineer there.

After the unveiling, Alderman Holland, who was Chairman of the Wigan Gas Committee before vesting date, spoke of the fine work done by the Board to recover the Wigan undertaking from the 'slough of despond' into which it had fallen.

Mr. R. L. Greaves, M.B.E., General Manager of the Board's South Lancashire Group, outlined the plans for taking gas to all the outlying districts in the Wigan area, and paid tribute to the work of his group officers.

The Mayor addresses the party at high tea. On his left is Mr. H. Butters, Member of the North Western Gas Board, and on his right Mr. R. L. Greaves, General Manager, South Lancashire Group, and Mr. Stanley Hopkinson, Group Sales and Service Officer.

Mr. Harry Butters, Board Member, who presided at tea, explained that the Board's policy was to bring better gas supplies and better service to its consumers. The new Wigan retort house was tangible evidence of that policy.

Wallingford Closing Down

THE works of the Wallingford (Berks) Gas Light and Coke Company bought by the Wallingford Corporation in 1899 for £8,500, and later nationalised, will stop production on March 1. Announcing this, the Manager, Mr. E. C. Heal, said that, some time ago, a main was laid via Wallingford from Reading to Oxford to help the city's supply. The Borough of Wallingford, with Crowmarsh, Winterbrook, Goring, Streatley and South Stoke—all supplied from the Wallingford works—were then tapped into this main.

The time had come when the Wallingford works could be closed and the gas for the 2,600 consumers in its area supplied from Reading. Gas can be made more economically at Reading than at Wallingford.

In addition to the Manager, the Wallingford plant employed 32 men. Of these, 26 will now be redundant. Six men will be retained at Wallingford and at the holder plant at Goring to continue distribution and servicing, which has always been carried out by the local plant. The office and gas showroom will remain open. The employees who will be losing their jobs have found alternative employment.

The Home Service Organiser for the North Thames Gas Board's Eastern Division, has arranged a series of evening cookery demonstrations (starting at 7 p.m.) at Leytonstone, for the benefit of young married women who might find it difficult to attend afternoon meetings. These demonstrations are proving extremely popular. The demonstration room at the Leytonstone showroom has a seating capacity of 80, but at the first demonstration more than 110 turned up, so afternoon overflow meetings have been attracting attendances averaging more than 40 without in any way affecting the attendances in the evening, when capacity audiences are still being maintained.

NURSING STUDENTS VISIT RADIATION

TWO parties of students were welcomed to the Essex Works of Radiation Ltd. recently. One party of 12 industrial nursing students, accompanied by the Sister Tutor, came from the Birmingham Accident Hospital. The other party were students from the National Foundry College at Wolverhampton. The chief interest of the nursing students was the surgery, the foundry baths, and the foundries themselves. The National Foundry College students visited the foundries and the pattern, core, and dressing shops.

Mr. Rigney, who is in charge of the foundry baths, and Mr. Sutton, one of the guides, with some of the industrial nursing students.

The Development of a

Temperature Limit and Overheat Control

By N. D. B. HARRIS, Assoc.M.Inst.Gas E.,
North Thames Gas Board

One of three short papers presented to the London and Southern Junior Gas Association on February 1.

IT is appreciated that the control which is the subject of this paper has somewhat limited uses, but devices of this nature must be available to meet the occasional demands of industry. Various types are already in existence, some electrically and some mechanically operated, but they are, for the most part, either expensive or form part of an expensive piece of apparatus.

Installation cost must also be taken into consideration since alterations to the gas supply, provision of electrical supplies, and the cutting of holes in the appliance casing are often entailed. It was with the object of reducing the overall cost that a new design of cut-off was developed, and this paper gives some of the practical problems involved from the first to the final model.

This type of control has two main uses in the gas industry. It can be used either for shutting off gas to a liquid heating tank or oven if, for some reason, the temperature rises above the processing temperature, or for shutting the plant down automatically once a predetermined temperature is reached. Here it may be argued that a second thermostat set at a higher temperature could be used to replace the cut-off. This is true if it is permissible to run the plant at the higher temperature, but there are occasions when complete shut down is essential in the event of overheating.

The second use mentioned above, which perhaps has a more practical value, can be found in the stoving of painted or lacquered articles in batch type ovens. Here the oven is loaded cold, heated to the required temperature, and shut down. Since in some cases there is no soaking time, shut down can be accomplished by means of a temperature limit control. With this device in operation the heat treatment may be carried out at night without attention. Thus the oven may be loaded one afternoon and unloaded the following morning. If the oven is manually controlled and night work is not possible, processing will be delayed until the following day, each load taking two days instead of one.

The cut-off which is most generally used for this purpose is mechanically operated. It comprises a spring or weight loaded valve held open by a chain which, by means of a system of levers and pulleys, passes into the oven, where the end is anchored. This chain is in two sections held together by a link of fusible alloy. When the alloy is heated to the melting point, the link parts and the valve closes under the action of the spring or weight.

Since this design, in common with many overheat controls, employs fusible alloys, a few words on the materials available will not be out of place.

Choice of Fusible Material

It is obvious that if the operation of a control is to be based on the melting of a metallic link, then the melting point must be sharp and, furthermore, reproducible. Pure metals, of course, possess these properties, but have widely separated melting points which are mostly outside the range for which this cut-off was designed. This is overcome by using eutectic alloys. These are alloys of two or more metals in such proportions that they have very sharply defined melting points. The lead-tin eutectic, which has a melting point of 183°C., has a composition of 37% lead and 63% tin. If other proportions are used, the alloy only begins to melt at this temperature and will not be completely molten until a higher temperature is reached.

Bismuth, lead, tin, and cadmium give a series of eutectic alloys having a convenient range of melting points: these are given in Table I[1] and were used throughout the work which is described here.

TABLE I.

EUTECTIC FUSIBLE ALLOYS.

Alloy	Melting point °C.	Melting point °F.
Bismuth-Lead-Tin-Cadmium ...	70	158
Bismuth-Cadmium-Lead ...	91	196
Bismuth-Lead-Tin	95	203
Bismuth-Cadmium-Tin	103	217
Bismuth-Lead	124	256
Bismuth-Tin	138	281
Tin-Lead-Cadmium	142	288
Bismuth-Cadmium	144	291
Tin-Cadmium	177	351
Tin-Lead	183	361

The control previously described not only presents many installation problems, but is inclined to be erratic in its behaviour. It has been found that its operation is dependent upon the rate of heating, the heat capacity of the fusible alloy and its fixing, and also the conduction of heat away from the alloy. In an endeavour to overcome these difficulties, experimental devices were made and tested in which each of the three types of mechanical force, compression, tension, and shear were employed in turn.

Fusible Material Under Compression

A new cut-off was designed to overcome the fixing problem and it was hoped that, at the same time, an improved performance would be obtained. This design, which is the subject of British Patent Application No. 23772/47, can be seen in Figs. 1 and 2. It comprised a spring loaded brass mushroom valve sliding in guides at the top and bottom of a cast brass body having 1½ in. B.S.P. female connections. When the valve was in the closed position the end of the valve stem projected ½ in. above the upper guide and when open it was just proud of the guide. Attached to a bracket on the side of the valve body was a ⅜ in. B.S.P. mild steel sheath, 12 in. long and slotted at the closed end, which contained a mild steel rod. This rod was parallel to the valve stem and 2½ in. from it. A short brass lever, pivoted at the centre to a bracket on the upper guide, made contact with both the top of the valve stem and the mild steel rod. The length of the sheath was adjusted so that when a fusible plug in the bottom of the sheath, below the rod, the brass bar held the valve stem down, thus holding the valve open against the spring.

This valve was to be fitted outside the oven with the sheath projecting through the outer casing. When the temperature of the oven was sufficient to melt the alloy, the mild steel rod, virtually shortened by the length of the plug, could no longer maintain the gas valve in the open position. The molten alloy escaped through holes in the end of the sheath and the valve closed under the action of the spring. The cut-off could then be reset by removing the pivot pin from the brass lever, withdrawing the mild steel rod, inserting a new plug, and re-assembling.

Tests were carried out on this device in conjunction with a drying oven. Plugs of different melting points were used

but with each it was found that the operating temperature varied with the heating up rate. The temperature of the sheath was measured by means of a thermocouple, attached to the end, while the oven temperature was measured by a mercury-in-glass thermometer.

Figures obtained with one of the plugs are given below:

	Temp. of Sheath when Cut-off Closed °F.	Temp. of Oven when Cut-off Closed °F.
Slow heating	195	230
Rapid heating	259	287

Melting point of alloy = 258°F.

It can be seen from these figures that if the heating rate is rapid, the alloy yields at a temperature very close to its melting point, while the temperature of the surrounding medium is far in excess. This is due almost entirely to the heat capacity and conduction of the mild steel sheath and rod. When the heating is slow the discrepancy between the temperature of the fusible alloy and the surrounding medium is practically the same as before, but the alloy temperature at the moment of yield is considerably below the melting point. This premature closing is caused by the alloy becoming plastic below the melting temperature and yielding under the compression.

It became apparent from the results of tests on this model that, although the method of installing the valve had been simplified, the old operating faults remained.

Fig. 1.

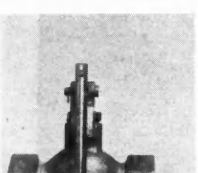


Fig. 2.

Fusible Material Under Tension

In an endeavour to overcome the adverse effect of the plasticity of the alloy it was decided to utilise this property and modify the valve to operate by tension. To do this, the valve stem was extended and turned down as in Fig. 3. A brass tube $\frac{3}{8}\frac{1}{4}$ in. outside diameter closed at one end was fitted to the base of the valve and swaged at a point $\frac{1}{4}$ in. from the end. This tube surrounded the valve stem extension and contained a small quantity of the fusible alloy. The valve was set by melting the alloy, depressing the top end of the valve stem, thus opening the valve, and then rapidly cooling the end of the sheath. It was considered that with a powerful spring under the valve and the low shear force required to release the valve from the alloy, the cut-off would operate within the plastic range.

Tests carried out on this modification showed that the same temperature lag existed between the oven temperature and the temperature of the fusible alloy. It was obvious from this that both the heat capacity and heat drain were too great and would have to be reduced before proceeding further.

A new valve stem extension was made from $\frac{1}{8}$ in. brass rod and a correspondingly smaller tube fitted to the valve body. Tests again showed that the heating rate affected the operating temperature, and the results obtained are given below.

	Temp. of Sheath when Cut-off Closed °F.	Temp. of Oven when Cut-off Closed °F.
Slow heating	240	265
Rapid heating	200	218

Melting point of alloy = 258°F.

Although there was a definite improvement in the performance, the construction was now too light to withstand service conditions, and work on this model was discontinued.

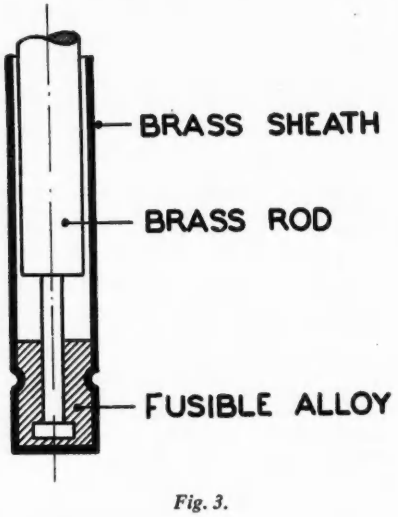


Fig. 3.

Fusible Material Under Shear

A further modification was made to the original cut-off, based on the previous design. In this version, the mild steel sheath was replaced by one of brass, having holes drilled in the side for the last 4 in. to reduce the heat capacity, which contained a mild steel rod with a reduced diameter

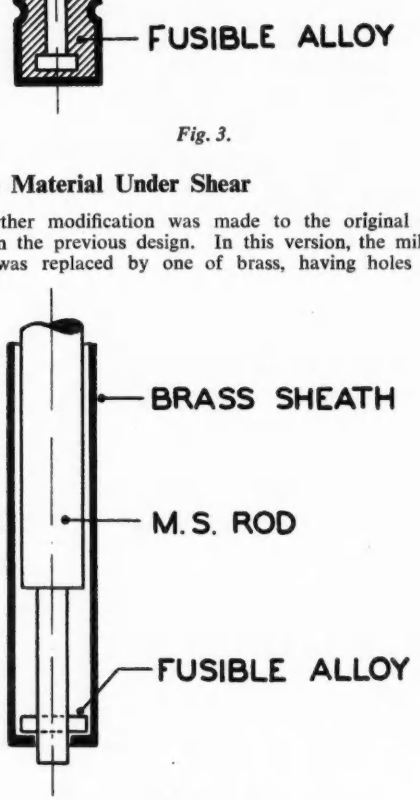


Fig. 4.

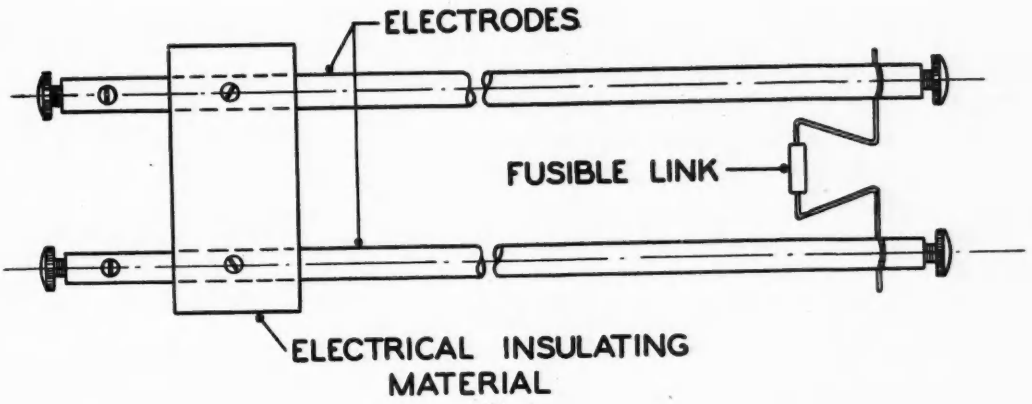


Fig. 5.

for the last 4¼ in. A rectangular slot was cut in the rod, near the end, to accommodate a short bar of fusible alloy. The rod, with the alloy in place, was inserted in the sheath and projected $\frac{1}{16}$ in. through a clearance hole at the end, as can be seen in Fig. 4. The object of this design was, once again, to utilise the plastic point rather than the melting point of the alloy and it was anticipated that the bar would shear as soon as the alloy became plastic.

As with all the other designs mentioned here, the operating temperature was found to be dependent upon the rate of heating. The temperature difference between the oven and sheath varied between 30°F. and 50°F., while the valve had an operating range of between 20°F. and 60°F. below the melting point.

Limitations of Mechanical Devices

From the foregoing results it was realised that the difficulties encountered in designing a satisfactory cut-off employing fusible alloys may be resolved into two distinct problems. These are. the effect of the heat capacity of the device, and the plasticity of the alloy below the melting point.

The temperature lag between the sheath and the oven is a direct result of the heat capacity. As already stated, the device must be of robust construction, and, since reduction in heat capacity is unavoidably accompanied by a reduction in mechanical strength, there is a limit to which the weight may be cut down. It follows, therefore, that a fairly high heat capacity must be accepted with a device of this nature. This could be allowed for by the selection of a suitable alloy if the temperature lag were constant, but, since it varies slightly with the rate of heating. this expedient cannot be adopted.

The plasticity of the alloy presents a greater problem as the plastic range is very wide and appears to vary with each alloy. It is this property which is largely responsible for the erratic behaviour of the models so far tested and it becomes obvious that any design of cut-off in which the alloy is subjected to either tension or compression is liable to 'creep' or premature closing.

It follows from the above that if any device is to give a repeatable and predictable performance it must have a low heat capacity, minimum heat drain on the alloy, and the fusible link must be under no mechanical stress. These conditions are most easily fulfilled when the link is part of an electric circuit.

Development of an Electrical Device

The inclusion of a fusible link in the circuit of an electromagnetic gas valve is a very simple matter, but it is not desirable to have bare probes at mains voltage in the oven, or even to have the possibility of a spark in the oven. If, in order to overcome this, the link is protected by a sheath, then the heat capacity is increased which, as has already been indicated, is undesirable.

Since much old and even more new gas equipment incorporates flame failure devices of the thermo-electric type, it was decided to investigate the possibility of including a fusible link in the thermocouple circuit. This method should not only show a considerable reduction in the cost of providing cut-off devices but also obviate the precautions necessary with mains voltage and the inconvenience caused by power cuts.

The first problem that arose was that of finding a suitable method for connecting the alloy in the electrical circuit so that it could be easily replaced and, at the same time, fulfil the requirements previously outlined. This was accomplished by casting rods ½ in. × ⅛ in. diameter in the various alloys and fusing 21 s.w.g. copper wire to the ends. A holder was made comprising two straight ⅛ in. brass rods, with clamping screws at either end, mounted in an electrically insulating block (Fig. 5). The length of the rods depends on the required position of the alloy in the oven or tank, but for test purposes, these were made 12 in. long.

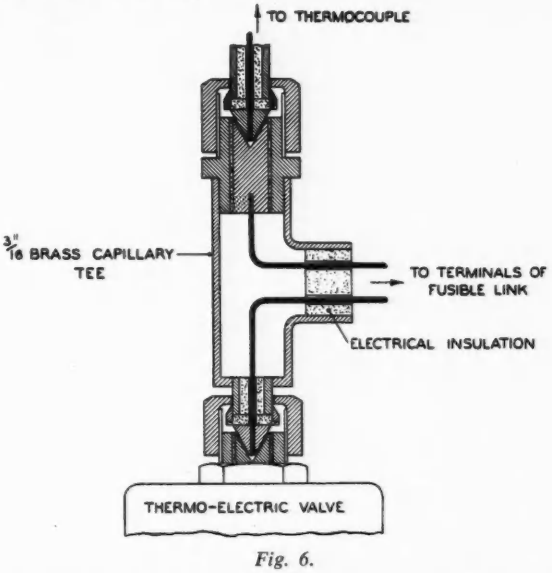


Fig. 6.

Next, an adaptor was made (Fig. 6) to enable the inner wire of the thermocouple to be connected to the other end of the electrodes, thus placing the link in series with the thermocouple and coil of the thermo-electric valve.

When the device was first tested, it was noticed that the alloy link parted before the melting point had been reached. This was partly due to the springiness of the copper wire, together with the distortion brought about by clamping; also, the two electrodes had been forced together slightly when the link was

fitted. This test was repeated with copper wire connections, bent as shown in Fig. 7, and fully annealed before being fitted to the electrodes; the performance was then satisfactory.

Further performance figures were obtained with the electrodes in a water bath and in a hot air oven to determine whether the results were repeatable. In the water bath the alloy, having a melting point of 203°F, melted at a bath temperature of 208°F, and in the hot air oven at 211°F, regardless of the rate of heating. It was also observed that, unlike previous designs, this cut-off remained open indefinitely even when the bath was maintained at a temperature only 3° below the melting point of the alloy.

The use of $\frac{1}{8}$ in. brass rods for the electrodes was considered undesirable as the device was not sufficiently robust to withstand the occasional knock which it would inevitably receive in use. From the encouraging results which had been so far obtained, it was suspected that the copper wires minimised the heat drain effects of the electrodes. With a view to confirming this, a similar device was made using $\frac{1}{2}$ in. brass rods in place of the $\frac{1}{8}$ in. When the performance was checked, this considerably heavier construction was found to give the same results as before, and $\frac{1}{4}$ in. diameter brass rod could, therefore, be used without fear of altering the performance.

Length of Leads

Having more or less decided upon the form the fusible link holder would take, the next problem to be solved was the maximum length of lead which could be used. This is directly related to the maximum permissible resistance of the complete circuit, and since the thermocouple provides only 20 to 30 millivolts at the solenoid winding the resistance must be kept to a minimum to obtain the necessary operating current.

In view of this relationship, the method for determining the maximum length of lead was based on the maximum resistance which could be added to the circuit. To avoid the inconvenience of long wires, fine copper wires (21 s.w.g.) were attached to the thermocouple and the necessary variation in resistance was obtained by clamping the electrode at different positions along these wires. The pilot burner was set at a gas pressure of 1 in. W.G. and the length of the lead was at first increased until the cut-off closed, then decreased until it could withstand a reasonable amount of vibration and shock without closing. This was repeated with pilot burner pressures of 2 and 3 in. W.G. and the lead resistance determined at each step.

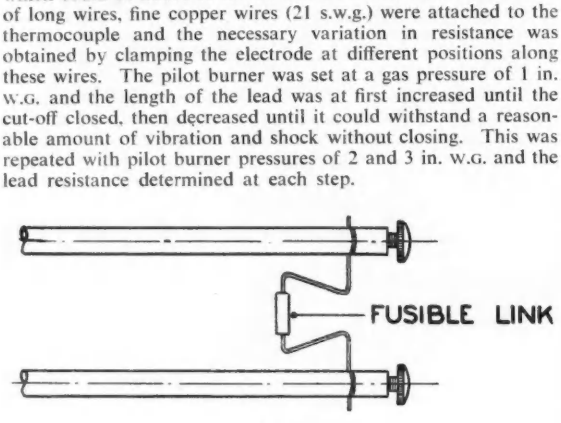


Fig. 7.

The figures which were obtained are given below:—

Gas Pressure in W.G.	Resistance Ohms
1	0.028
2	0.045
3	0.064

To allow a good margin of safety, since conditions under which thermo-electric valves are fitted vary considerably, it was decided to base all lead-lengths on a maximum resistance of 0.028 ohms. This value, unfortunately, limits the length of a lead in V.I.R. cable (7029) to 6 ft. In endeavouring to increase this distance, the use of Pyrotenax cable was investigated. This cable consists of a copper sheath containing a heavy gauge copper core surrounded by compressed magnesium oxide. A 12 ft. length of this cable having the same outside diameter as the thermocouple was found to be within the required resistance limit. This also had the advantage of enabling the same type of union to be used for the fusible link connections as is used for the thermocouple connections.

The proposed method for installing this control is to fit an adaptor to the cut-off valve and attach both the thermocouple and the fusible link leads to it. The position of the various controls must be carefully planned so as to keep the length of lead to a minimum.

It may often be possible to reduce the length of the lead by installing the link in a hotter part of the oven or even in the flue. In such circumstances the temperature difference between the working space and the position of the fusible link would have to be taken into account in the selection of a suitable alloy.

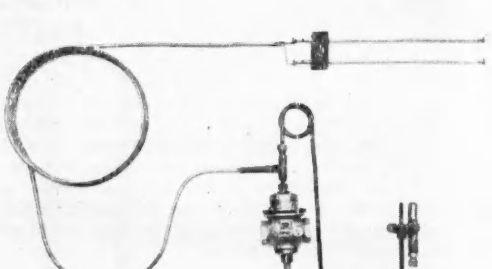


Fig. 8.

Fig. 8 is a photograph of the complete cut-off and thermo-electric flame failure device incorporating the features which have been described; this arrangement is the subject of British Patent Application No. 15191/49.

REFERENCE

1 Fry's Metal Foundries, Ltd. Technical Leaflet No. 4—"Fusible Alloys," page 4.

FOUNDED ON FACT

IRON foundries play an important and indeed vital part in the economy of this country. This is the conclusion to be drawn from 'Founded on Fact,' a booklet by Mr. Basil H. Tripp, published by the Council of Ironfoundry Associations.

He shows what would happen if a ray destroying all iron castings were suddenly turned on. The effect would be crippling. Nearly every cooking appliance would disappear, transport would be immobilised on land, sea and in the air, there would be widespread power failures, telecommunications would disappear and around our houses and in the streets there would be yawning gaps where the covers of our drainage system had been. All internal combustion engines would collapse. Factory production would come to an end, for the cast iron bedplates and frames for innumerable machines would have gone, leaving the shining steel of the working parts useless on the factory floor.

The man-in-the-street has no conception of the fact that cast iron enters into all these products.

Total United Kingdom tinplate production in 1951 barely kept pace with that of 1950. Statistics published by the Tin Study Group (which exclude blackplate) show that production for January to September was 480,400 tons of tinplate, an annual rate of about 640,000 tons, compared with 662,800 tons for the previous year. Exports in 1951, based on the January-September figure of 180,000 tons, were about 243,000 tons, compared with 250,000 tons in 1950. By subtraction, apparent consumption on the home market was about 397,100 tons of tinplate during 1951, compared with 416,000 tons in 1950. Actual consumption in 1951 was probably rather higher, due to withdrawals from stocks.

UNACCOUNTED-FOR GAS

The following is a report of the discussion which took place at a meeting of the Midland Section of the Institution of Gas Engineers on the Report (Communication No. 380) of the Sub-committee on Unaccounted-for Gas of the Institution. The report was presented at the Institution research meeting in 1951 and has already been discussed by the North of England Section (*Journal* of January 2, 1952, p. 56)

AT the meeting of the Midland Section, I.G.E., held in Birmingham on February 8, the report was introduced by **Mr. F. L. Atkin** (Chief Distributing Engineer, West Midlands Gas Board). Mr. Alexander Tran, Chairman of the Section, presided.

The Accountant's Viewpoint

Mr. R. Thompson (Deputy Chief Accountant, East Midlands Area Board) said the subject was one in which the accountant was interested particularly in regard to reduction of unaccounted-for gas and the calculation of unread gas.

Two aspects were presented to the accountant, the first being the consideration of costs and the second the effect in the financial accounts. To the cost accountant unaccounted-for gas represented a hidden overhead which could not be evaluated as an item of expenditure but must always be taken into account in assessing costs of production or sales of gas. The cost accountant was therefore naturally interested in the report not only in regard to the suggested methods of calculation but also to the factors influencing unaccounted-for gas. He must ensure that in his investigations he was dealing with an actual reduction and not an apparent reduction arising from the mathematical application of the various methods of calculation and adjustment given in the report.

In assessing the value of any reductions the cost accountant must have the co-operation of the engineer, particularly in regard to such things as district tests and surveys, meter tests, etc. Much of this work would not provide figures capable of mathematical proof but would undoubtedly contribute towards effective savings. The effort was worth while when a saving of 1% in unaccounted-for gas was valued on the total costs of production shown by the accounts of any area board.

In the balance-sheet of a gas board there appeared under 'current assets' an item entitled 'accrued revenue for gas and rentals,' and the value of 'unread gas' is included in the revenue account as income from sale of gas. As a matter of accounting principle this figure should not be subject to adjustment to reach agreement any more than stocks should be manipulated to adjust a profit. The computation of the value of unread gas must satisfy the auditors and was also of interest to the Inland Revenue.

Factual and Estimated Factors

The suggested procedure of recalculation was difficult to support when one realised that most of the basic figures used for calculating unread gas were factual whereas the data used for ascertaining unaccounted-for gas contained many postulates and estimated factors. Any adjustment for this recalculation must be to the factor 'percentage of gas sent out' which, in the method given in the report, was a balancing figure after accepting an estimate of unaccounted-for gas. A method which would be more acceptable to the accountant would be to calculate unread gas and add the other known items leaving the balance as unaccounted-for.

Certain factors in the computation of unread gas must be fixed no matter what method was adopted, and these were clearly indicated in the report. There were, however, considerable differences in opinion as to whether the calculation should be made on 'gas sent out' or 'gas sold for the quarter.' He preferred the latter as it included the correct unaccounted-for element, but he did not think that any great difference would accrue if the method given in the report was adopted, because an adjustment was made to arrive at the 'saleable gas sent out.' Whichever method was adopted it was essential that all computations were on the same basis.

There was another point which was of accounting interest and that was the adjustment to 'gas passing consumers' meters.' Undoubtedly the engineer would feel justified in asking for such adjustment to compensate for adjustments to works records, but for accounting purposes the adjustment could have no monetary value and remained unaccounted-for in the books of account. The value of the report lay in the provision of a standard method of calculation, and this was basically sound even though several of the adjustments gave rise to argument and many might consider simplification necessary.

Mr. A. Facer (Manager, Derby sub-division) said he had hoped that the sub-committee would have been able to give some modifications to Table I of Section III, which also appeared in the interim report published in 1938. The Committee stated that the adoption of this table was somewhat arbitrary. He thought he was correct in saying that when the table was originally issued in the 1938 report, it was extracted from a work published in 1898. From the discussion on the interim report, it did appear that certain of the larger undertakings were investigating this point, and he was disappointed that their findings could not have been incorporated in the report before them.

Testing Station Meters

Both in the interim report and in the present one it has been stressed that drum type station meters should be tested regularly and given adequate maintenance, and with this he agreed. He was, however, at a loss to understand what was really meant by Section IV(a) where they were asked to believe that the testing of station meters by a 3,000 cu.ft. per hour wet meter on successively larger meters was accurate to within 0.25%. Did this statement mean that because successively larger meters were tested and agreed with the 3,000 cu.ft. per hour test meter all within this tolerance, that the meters were necessarily correct? It should be remembered that most, if not all, of these meters were originally calibrated against a slow drum test. He agreed with the statement in the report that a slow drum test would exaggerate the losses due to leakage, but he could not agree that a meter tested at slow speed necessarily registered accurately at high rates of revolution. Although the differential pressure across a meter increased with the speed of the meter, this would not affect the registration if the equilibrium pipe was of adequate size and was free from obstruction and the water level inside the drum coincided with the water gauge line.

During the slow speed test there was practically no surge within the measuring compartment of the meter drum, but the conditions were vastly different when this type of station meter was operating at maximum capacity, when there was frequently a definite surge. In his view this was bound to make an appreciable difference to the accuracy of the meter. If the drum type station meter was overloaded, the effect of surge was even more serious. For the above reasons, Section IV(a) was misleading. In regard to testing he definitely preferred to use an impeller test meter at rates more nearly approaching the capacity of the meter to be tested, as indicated in Section IV(b). Section IV of the report also referred to 'water lining,' which seemed to be a bad choice of wording. Surely 'correct water level' would have been more appropriate.

Mr. Facer then referred to tests which indicated that where excessive variations were likely to occur in the gas streams metered by drum type meters it was very important that adequate water feed and adequate overflow pipes should be provided; otherwise such meters could register inaccurately for considerable periods even though the meters had been proved correct by either the slow drum tests or tests more nearly approaching their normal speed. It was appreciated, of course, that on new modern works this problem was not likely to arise, but there must still be many works operating with wet drum meters where such conditions could apply and might have been overlooked.

Reverting to Section IV of the report, under 'Consumers'

Meters' mention was made rather briefly of the statutory limits laid down by the Ministry of Fuel and Power regarding the accuracy of such meters. He disagreed with the Committee's statement that no further reference need be made in a report on unaccounted-for gas to the above statutory limits, since to his mind there was likely to be a consistent loss of revenue to all gas undertakings because of the statutory limits giving 3% in favour of the consumer as against 2% in favour of a gas undertaking, which might be expected to give unaccounted-for gas to the extent of 0.5%. He thought this point, although elementary, might have been mentioned in the report, especially since it was referred to frequently during the discussions on the interim report published in 1938.

An additional complication which had not been referred to in this Section concerned those areas which received coke oven gas supplies, and particularly where crude coke oven gas was purchased. In order to arrive at a true unaccounted-for figure it was necessary to apply a further correction to the corrected gas volumes as purchased, due to the fact that such gas must be purified by the undertaking before it could be sold to consumers. It was necessary to make a correction for the change in calorific value and also for the change in volume occasioned by purification and air admission to purifiers.

Apart from crude coke oven gas supplies, similar corrections would be required where the new practice was being introduced by works of metering crude coal gas and crude carburetted water gas from each unit of production and where gas was not metered after purification. Since this practice was growing, it seemed unfortunate that the Sub-committee did not include a brief note on the necessary corrections.

Corrections for Altitude

Mr. S. C Bentley (Oxford) said the suggested correction for altitude to the barometric readings might need extension in the case of an undertaking supplying distant townships, especially in hilly districts, and individual corrections might be made for the gas recorded in separate areas. For instance in his own group corrections for altitude affected the volume by percentages ranging from −0.46% to +0.01%. The altitude correction should not be applied to the pressure of gas used on works, to be strictly accurate, although the report suggested that the correction factor used for gas used by consumers should be applied to gas used on works. With the best distribution system the pressures at consumers' meters varied considerably, the variation usually being at a maximum when the maximum amount of gas was being measured, and the pressure used in calculation could only be arbitrary, with 4 in. W.G. as reasonable a figure as possible.

As more and more gasholders were automatically controlled a possible source of leakage was failure of the limit controls or leakage by inlet valves, enabling gas to be admitted to a full holder and loss of gas by blowing. Regular inspection and testing of controls and valves would prevent this. A point affecting the accuracy of district B.M meters was the stripping action of the oil on the gas. If the extent of benzole extraction at the works was reduced the meter oil level rose and the meter read fast, but when extra benzole was extracted at the works the gas picked up the lighter constituents of the meter oil and the meter read slow until the correct level was restored.

All refinements of correction for temperature, pressure, and humidity were of small importance in relation to the estimation of unread gas at the end of a quarter, and the greatest care was required in estimating this figure. The method described in the report was probably the best, but it involved an enormous amount of clerical work, complicated by such things as special readings, short time in industry, school holidays, and other factors producing varying consumer group consumption percentages during a quarter.

Question of Cost

Mr. W. A. Pask (Sub-Divisional Manager, Leicester) said he asked himself why they wanted to be able to determine with greater accuracy what they called unaccounted-for gas. He could only find one answer, and that was that they wished to have some more positive method of making a comparison between what was their unaccounted-for gas and that of their friends and neighbours. But as business men they would ask what it was going to cost and what it was going to bring back in the way of dividend. So the question really was whether it was worth while. It might be found that the application of some of the rules and formulæ would give a different result, but all they did was to change the figures on paper. The committee looking into the question had investigated it very thoroughly and had given them a tremendous amount of information. They were to be heartily commended on the report, but he would very much like to have information as to what was the difference between the application of this type of formulæ and rules and the existing much simpler methods of finding out what was their unaccounted-for gas.

Mr. W. H. Blundston (Engineer and Manager, Hereford) was of opinion that there should be far more frequent testing of meters.

Mr. C. F. W. Rendle (Divisional Manager, Worcester) said it was their business, *inter alia*, to make large volumes of gas and to account for as much of it as possible by sale to consumers. Moreover, it was expedient for them in the prosecution of efficiency, and particularly so now that a large number of gas undertakings were centrally controlled, to compare the efficiency of one works or plant with another and each with its own previous performance. It was appreciated, therefore, that the correction of measured volumes to standard conditions of temperature and pressure was essential for this purpose.

In their aim for greater efficiency, it was natural that they should deal with thermal efficiency because their saleable products were used to produce heat. This incidentally provided them with an added incentive to the correction of volumes to standard conditions because the same practice was used in the statutorily prescribed method of determining heat values of gases.

Under prevailing atmospheric conditions it was not unusual to find that the measured volume differed from the corrected volume by a substantial margin. To the extent to which they used this corrected volume of gas made by comparison with the uncorrected measured volume of gas sold in order to assess that for which they could not account, they were creating a misleading difference.

Unnecessary Statistical Binders

It was here, of course, that the methods of calculation devised by the I.G.E. Sub-committee pointed the way to a solution—but at what cost? The method was of necessity complicated. At its best it was only an approximation of the standard volume accounted for by consumers' meters. It was, moreover, even today, impracticable to apply it to a considerable number of the smaller undertakings. If they used it in application only to large undertakings and thus dealt with the greater part of their total volume in any area or division, it would again be merely a good approximation.

It was pertinent to ask the question 'Is it either necessary or useful to use the complete method of calculation?' They remembered in the days before nationalisation how gas engineers might be found busy with calculations of unaccounted-for gas at the end of a period and that if the result was a modestly low figure it appeared with a suitable reference in the annual report. If it were high, it did not appear at all, but, in either case, little action ensued other than the continuance (or establishment) of accepted proper practice.

Was there any difference today? It seemed to him that, having assumed, as they must, that all precautions were used to avoid actual leakage of gas from holders, mains, and services, and having arranged to maintain consumers' meters in good condition and accuracy and to record their registration regularly, they had accomplished by far the major part of the remedial measures which any revealed unaccounted-for gas implied. In other words, such measures constituted proper practice which needed no special inducement and should be employed whatever the unaccounted-for volume might be.

The need for greater diligence in exercising good management was readily revealed by observation of matters obtainable through existing channels of organisation. He suggested that to produce by elaborate and involved methods an approximate factor which would serve no additional purpose would impose an unnecessary statistical burden upon the staff concerned.

On the motion of **Mr. J. E. Wakeford,** seconded by **Mr. W. Macnaughton** a cordial vote of thanks was passed to Mr. Atkin for having introduced the report.

POWER GENERATION IN GASWORKS*

By W. A. TRAIN,
W. H. Allen, Sons & Co., Ltd., Bedford.

TO make the best possible use of the steam generated by waste heat boilers, it is preferable to employ it for two purposes only—for the exhauster prime mover and for a pass-out turbo-alternator. The main reason for the improved efficiency is the use of using two large prime movers as opposed to a great many smaller machines exhausting to atmosphere. In addition, the steam pipe condensation losses can be reduced to a minimum as the exhauster and power houses can be sited adjacent to the carbonising plant where the steam is generated and a large proportion of the low-pressure steam is required.

Steam Drives

The exhauster should be driven by a back pressure reciprocating steam engine or steam turbine as opposed to an electric motor. Both steam turbines and reciprocating steam engines lend themselves readily to infinitely variable speed control over the range required. This is more complicated to obtain from the electrical supply. Secondly, the exhauster runs continuously and the back pressure steam can readily be absorbed in the process of gas manufacture. Thirdly, the mechanical and electrical conversion losses are avoided, which is of importance on this base load equipment.

The Roots type of exhauster is ideal for gas quantities up to about 500,000 cu.ft. per hour, and by virtue of its low rotational speed lends itself to being driven by a reciprocating steam engine, the efficiency of which is higher than a steam turbine when operating under similar conditions. It is possible, of course, in the light of future developments, that the steam turbine will in due course become more efficient, and then this picture may change.

For quantities in excess of 500,000 cu.ft. of gas per hour a centrifugal type of exhauster has an advantage owing to its smaller physical dimensions. Also, the turbine more closely approaches the reciprocating engine in respect of steam consumption as the horse-power increases.

Pass-out Turbo-Alternators

The pass-out turbo-alternator actually consists of two distinct turbines driving one alternator. The first portion, or H.P. turbine, is a back pressure unit, and the second portion, or L.P. turbine, is a condensing unit. The back pressure of the H.P. turbine is maintained at a constant figure, irrespective of the flow of steam, by throttling the steam to the inlet of the L.P. machine.

The turbo-alternator should be designed to run in parallel with the electrical grid system and absorb all the steam available from the waste heat boilers, after allowing for the requirements of the exhauster plant. The pass-out steam quantity should cover the process requirements, and in these circumstances the turbine ties up all the loose ends, both steam and electrical, as any surplus steam over and above the process requirements is passed through the turbine to the condenser, and any surplus power generated by the alternator is fed into the supply mains. Conversely, should the works electrical load exceed the output of the alternator, the balance is taken from the grid.

It is virtually impossible to use a back pressure turbo-alternator, since the low pressure steam demand is bound to vary, not only in relation to the output of the waste heat boilers, but also due to seasonal changes in demand of gas and varying requirements due to changes in atmospheric temperature.

The steam flow from waste heat boilers in a gasworks is liable to variation due to fluctuations in the waste heat supplied to the boiler plant and the incidence of steam demand from exhauster. This means that the usual method of governing a turbo-alternator, whereby the steam flow is restricted to suit the electrical load required, cannot be employed. The electrical power generated will, of course, fluctuate with the steam flow and the governor gear must ensure that the turbo-alternator generates the maximum number of kilowatts possible from the steam quantity available at any given instant. The method of governing employed must be independent of the turbo-alternator speed governor, since, for running in parallel with the public supply, the speed governor must be put out of action, after paralleling, to allow the speed of the set to follow the supply frequency.

The only satisfactory solution of this problem is to provide an inlet pressure regulator in association with automatic nozzle control. The inlet pressure regulator maintains a constant inlet steam pressure by adjusting automatically, through the nozzle control gear, the area of high pressure nozzle open to steam to suit the quantity flowing. This has the effect of maintaining a virtually constant heat drop across the turbine, which is an essential condition for developing the maximum power possible from varying steam flows. A further advantage is that the turbine cannot overdraw the boiler plant and rob vital auxiliary machinery of steam, or cause priming due to reduced boiler pressures.

The final setting of the speed governor is such that, should there be a failure of the public supply and the speed of the turbo-alternator rise unduly, the speed governor will come into operation and over-ride the inlet pressure governor, thus acting as a pre-emergency governor to prevent the turbo-alternator being shut down.

Automatic Valves

The automatic nozzle control valves provided usually deal between them with from a quarter to a third of the total maximum amount of steam which can pass through the turbine, and this range is found sufficient to deal with all normal variations in steam flow. Usually, however, more steam is available in winter than in summer, and therefore, in addition to the automatic nozzle control valves, one or two hand-operated nozzle control valves are also provided, feeding steam to further groups of nozzles, each of these hand-controlled groups being roughly equal to the total number of automatic valves. Thus, by using one or two hand valves in conjunction with the automatic valves, the range of the latter can be placed at any one of three different stop-valve steam flows, thus covering any flow from about one-quarter to maximum.

The presence or absence of automatic nozzle control valves need not affect steam consumption guarantees where figures are given for selected conditions, since the provision of a small number of hand-operated valves, if carefully adjusted in the correct combinations, will make it possible to obtain the full pressure on the nozzles at different steam flows, with consequent low steam consumption guarantees. These low consumptions, however, will only be obtained in very carefully adjusted test conditions, where the load and pass-out steam quantity can be regulated exactly to the guarantee conditions, and the hand-valves set to suit. In actual working conditions this is never possible, since the throttle and pass-out steam quantities are continually varying and the only course which can be adopted by the attendant of a turbine having only hand controls is to open the number which will give (with ample margin) the maximum load and pass-out steam quantity which can possibly be required, and at all other steam

* Paper to the Scottish Junior Gas Association at a joint meeting of the Eastern and Western Districts, Edinburgh.

flows considerable throttling is taking place, with a diminution in the power obtained from the steam available.

Pass-out turbo-alternators vary in price from about £15 per kilowatt for sets of 2,500 kW capacity to about £30 per kilowatt for sets of 500 kW capacity. It is virtually impossible to generalise in connection with the cost of power generated, but one might expect to receive a sum from the B.E.A. equivalent to the cost of generating the power which is surplus to works requirements.

Although this may not sound very attractive it must be borne in mind that the primary reason for installing the turbine is not to generate power for export, but to use the waste heat steam efficiently, which results in making available for sale valuable solid fuel which would otherwise have to be used for steam raising, or having to purchase power from the grid at over 1d. per unit. The earning from the sale of power should be looked upon as a bonus. In any event, the advantages of parallel operation do give the balance effect which has previously been referred to.

Gas Turbine

An order has been placed for a closed-cycle gas turbine for generating power from the hot waste gases of a carbonising plant. An open-cycle gas turbine has also been suggested. The amount of power it is possible to produce with such a machine is approximately 20% greater than with a pass-out turbo-alternator and 40% greater if a back pressure steam turbine is used in conjunction with the gas turbine. Several cases have been investigated and it would appear that the increased capital cost involved for the gas turbine and alterations to the waste gas mains, buildings, etc., makes it of greater interest when it prevents power having to be purchased at about 1d. per unit from the grid.

Undoubtedly, the gas turbine will be developed to give greater power in the future and the cost may not go up in proportion. If this proves correct, then the picture may alter to such an extent that the gas turbine will be able to hold its own with the steam turbo-alternator.

The Alternator

Referring to the electrical end of a power plant, the alternator should be of the totally-enclosed, water-cooled type to prevent the ingress of corrosive gases and dust. It is not possible to lay down any hard and fast rules regarding the voltage at which the alternator should operate, but it is reasonable to assume that, if the majority of the power is required on the works, the machine should be wound for low tension and a step-up transformer employed to export the surplus to the grid. If, however, the works lead is low as compared with the output of the machine, then it is preferable to generate at high tension and use a step-down transformer for the works requirements.

With water gas plants most of the steam generated is used in the process of gas-making. Again, the main turbo-alternator should operate as closely as possible to the designed conditions to obtain the highest efficiency. If, therefore, the machine has to be designed for widely varying flows, as would be the case with water gas plant, the efficiency for most of the time would not be at the optimum figure. In other words, a compromise is rarely justified for water gas plants in the average works.

There are, of course, exceptions, one such case being the Humphreys and Glasgow plant at the Beckton works of the North Thames Gas Board. This particular plant, which is now in operation, is sufficiently large and operates for periods which justify the use of a pass-out turbo-alternator in the installation. It consists of a carburetted water gas plant designed to yield 18 mill. cu.ft. of gas per day at a calorific value of 520 B.Th.U. The waste heat boilers raise 26,000 lb. of steam per hour at 300 lb. per sq. in., with total temperature varying from 410°F. to 650°F., 590°F. being used as the design figure. The turbine is arranged to pass-out 10,800 lb. of steam per hour, which is the additional amount of steam required over and above the yield of the jacket boilers for the gas-making process. The output of the alternator is 1,390 kW.

To protect the generator in emergency, and to cope with the cyclical fluctuations of the plant, special steam control gear has been fitted.

The following tariff was negotiated by a Midlands undertaking. When buying, a maximum demand charge has been arranged on a daily basis.

For Selling to the B.E.A.

(a) 10s. for each continuous kW per month supplied in the months of January, February, March, November, and December between the hours of 7 a.m. and 5.30 p.m. on weekdays and 7 a.m. and 12.30 p.m. on Saturdays—that is, during the surcharge hours the price will be fixed on the minimum kW output for each month.

(b) 0.154d. plus 0.001d. for each 5% by which the annual load factor exceeds 50%, subject to a maximum of 0.006d. per unit.

(c) The previous 0.154d. to be subject to a tolerance of plus or minus 0.0007d. for each penny by which the fuel as charged at the power station varies from 38s. per ton. This tolerance is further to be adjusted in the ratio of the existing calorific value to 11,000.

For Buying from the B.E.A.

(a) A fixed monthly payment of £20 in respect of a standby of 300 kW.

(b) A maximum demand charge of 4½d. per day per kVA of maximum demand.

(c) A running charge of 0.48d. per unit subject to an increase of 0.0007d. for each penny by which the average cost of fuel per ton multiplied by 11,000 over the gross thermal value is above 38s. per ton.

SMETHWICK INDUSTRY

SMETHWICK industrialists warned last week's meeting of the local council that industry would emigrate from the borough if the town's 20-year development plan goes through. A protest is also to be lodged with the Minister of Housing and Local Government against the plan, which proposes to move industry from various parts of the town and concentrate it in the north and east areas. In a statement issued after a private meeting, the industrialists said that the concentration of industry was bad because the great concentration of passenger transport would cause chaos during factory starting and stopping times; the heavy commercial traffic would be concentrated in the area, causing congestion and delays; expansion of firms already in the north and east areas would be prevented; West Bromwich, an adjoining authority, had development proposals in the area and the concentration of industry would be strategically wrong in time of war.

The statement continued: 'If the plan were approved, industrial consequences would be serious in that there would be emigration of industry from the borough, and this would inevitably raise costs because industries have grown up in Smethwick by reason of the town's favourable geographical position as regards the proximity of raw material, ancillary industries, and in many cases its consumer market.'

The industries of Smethwick are largely traditional and have created a skilled labour force which is not available elsewhere. The meeting regretted that there had been an absence of consultations between the local authorities and industry during the preparation of the plan.

The Coking Plant at Lourche, put into service in the Nord et Pas-de-Calais coalfield in 1937 and comprising three batteries totalling 77 ovens with a production of 600 tons a day, is to give way to two new batteries of 23 ovens each capable of producing 1,300 tons daily. The first of the two new batteries will be started up this month. The second will be started early in March. The Usinor blast furnaces will take most of the metallurgical coke produced.

COMPANY NEWS

MIDLAND TAR

The 29th annual meeting of Midland Tar Distillers, Ltd., was held on February 6. Mr. Stanley J. L. Robinson (the Chairman), who presided, said the net profit was slightly up, but the Board did not consider that this justified a departure from the conservative policy practised in the past. It was recommended that the dividend be maintained at 8% and that of the balance available, £30,000 be transferred to general reserve, making this figure £300,000 and £20,000 to reserve for obsolescence and increased replacement costs, making this figure £190,000. A major operation at Four Ashes was the erection of a new tar acid plant which would refine the tar acids which the Company was producing in increasing quantites.

POWERS-SAMAS ISSUE

The result of the offer of 920,000 ordinary shares of 10s. each at 37s. 6d. per share by Powers-Samas Accounting Machines is that acceptances under the offer totalled approximately 96%. Applications for additional shares were considerably in excess of the 36,711 shares available and allotments in respect of the larger applications had to be heavily scaled down.

GEORGE COHEN

The board of George Cohen Sons & Co., Ltd. (iron, metal and machinery merchants and engineers), has resolved that an interim dividend of 8% actual, less tax, be paid on the £600,000 ordinary stock of the company on March 31, 1952, in respect of the year ending on that date; that the half-yearly dividend due on March 31, 1952, on the £1,500,000 4½% cumulative preference stock be paid at the rate of 4½% per annum, less tax.

STAVELEY INVESTMENT

A final dividend of 7½% actual, less income tax, making 10% for the year ended December 31, 1951 (last year 7½% for year) is recommended by the board of Staveley Investment Trust, Ltd. Net revenue available for dividend is £26,259 (after income tax £24,437). Last year net revenue £21,399 (after income-tax £17,345). With the £33,787 brought forward from last year there is a balance of £42,011 of which £25,000 has been transferred to general reserve leaving £17,011 to be carried forward.

Two Further Series of Talks on water heater design, installation, and practice were recently delivered by Mr. J. Gibbons, of Main Water Heaters, Ltd. During the week ended February 2, Mr. Gibbons's talks were given at Maidstone to the district staff of the Maidstone Group of the South Eastern Gas Board, and, during the week ended February 9, at St. Albans, Hitchin, Luton, and Watford to the fitting staff of the Watford Division of the Eastern Gas Board. The lectures dealt with gas water heating in general and with Main's storage and instantaneous bath water heaters in particular.

METROPOLITAN GAS METERS

The consolidated balance sheet of Metropolitan Gas Meters, Ltd., shows current assets £143,181 (£136,044), current liabilities £32,458 (£31,110). It is proposed to cancel and repay all the outstanding £23,977 of preference capital (£1,023 has already been redeemed), and restore the authorised capital to the present figure of £100,000—including £75,000 ordinary—by creating 250,000 new ordinary 2s. shares.

POWER GAS

The 52nd annual general meeting of the Power-Gas Corporation, Ltd., was held on January 30 at Parkfield Works, Stockton-on-Tees, Captain A. Hayton Cowap, F.R.S.A., vice-chairman, presiding in the absence overseas of the chairman and managing director, Mr. N. E. Rambush, D.SC.(HON.), A.M.I.CHEM.E., F.R.S.A.

In his statement circulated to the shareholders the chairman and managing director stated that, although the group trading profits for the year, £547,000, established a new record, the recommendation to retain the same dividend distribution (12½%) was largely governed by the programme of capital expenditure upon which the company had embarked.

During the year the company had secured contracts amounting in value to approximately £5 mill., and since the opening of the financial year the rate of booking contracts had been well sustained. They were committed to a degree unparalleled in their history to projects serving the iron, steel, gas and chemical industries. The company had also been entrusted with orders from gas undertakings for 23 automatic mechanical carburetted water gas plants. They had acquired during the year rights for the exploitation of important new specialities, including the Wiggins gasholder, the Panindco dust gasification system for the production of a high-grade gas from low-grade fuels, the Hercules processes for the catalytic production of hydrogen and carbon monoxide from richer gases, and the Pease Anthony scrubber for cleaning and washing industrial gases.

COLONIAL GAS ASSOCIATION

Addressing the 63rd annual general meeting of the Colonial Gas Association, the Chairman, Mr. C. F. Broadhead, M.I.C.E., said that insufficient coal had been available for the gas industry and rationing of the use of gas had to be enforced for several months of the year. In addition, the price of coal had soared during the year, adding £100,000 to the cost. Poor quality alone increased expenditure for the year by £55,000, the total cost of coal representing an increase of 44% over the 1950 figures. Increasing costs due to wages had a marked effect on the accounts; labour costs were 20% greater than for the former year. On the average, the price of gas for all works was 1s. 4.3d. per 1,000 cu. ft. higher than for 1950, which was totally inadequate to meet rising costs. The Gas and Fuel Corporation had acquired the undertakings of the Metropolitan Gas Company and the Brighton Gas Company, and it would seem to be inevitable that it would sooner or later acquire other undertakings in Victoria, including the Victorian works of the Association.

New Companies in 1951

IN 1951, the total number of new companies placed on the register in London (relating to England and Wales) was 12,932; a slight reduction of 2.6% from the 1950 total of 13,278. The nominal capital of those companies was £94,781,886, which compares with £67,762,072 for the previous year; in this respect an increase of nearly 40%. The average nominal capital on registration of companies having a share capital, both public and private, was £7,329 as against £5,104. New companies incorporated in London totalled 10,578 in 1939 and 13,755 in 1949.

Only the same number of public companies (26) as in 1950 made their appearance. Their combined capital on registration, however, jumped from £1,226,725 to £23,653,601. The figures do not record the conversions of private into public companies, nor the increases of capital which often occur to shares being offered to the public or otherwise marketed.

The formation of new private companies continues above pre-war levels. No fewer than 12,761 were incorporated with a nominal capital of £71,128,825. This compares with 13,095 in 1950 with a total nominal capital of £66,535,347.

In 1950 the six most active classes were food, engineers, builders, clothing, land and properties, and merchants (distribution). The 1951 figures reveal the same classifications as the top six, but the slowly developing re-armament programme no doubt accounts for the fact that the engineering industry has the greatest total.

With respect to initial capital, however, the 'investment, finance, and banking' class takes precedence of 'engineers' with 'shipping' and 'textiles' closely following them.

In 1951 there were 187 companies incorporated with initial capitals of £50,000 and over compared with 198 in 1950. There were 145 registrations of 'Guarantee' companies being societies, institutions and unincorporated bodies established for a wide range of purposes. Some, which are 'associations not for profit,' receive a lincence from the Board of Trade to dispense with the word 'Limited.'

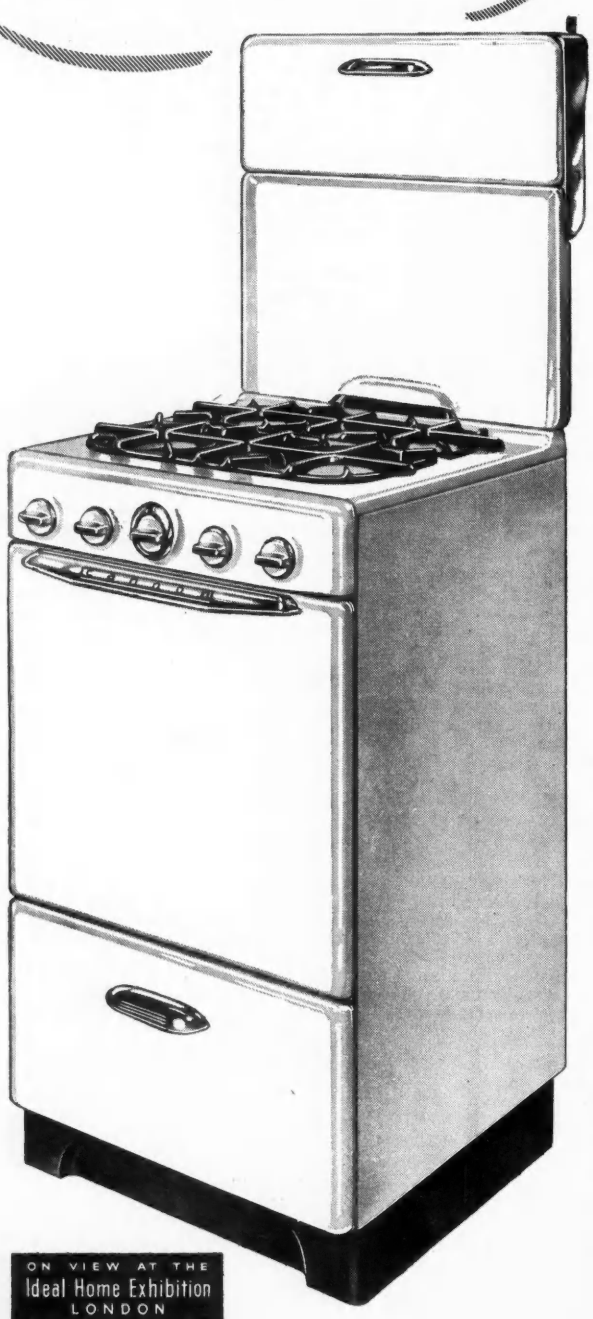
These statistics, which have been compiled from official sources, are taken from a report prepared by Jordan & Sons, Ltd., Company Registration Agents, Chancery Lane, W.C.2.

Verrolec, Ltd., have removed to 27, Balfour House, Finsbury Pavement, Moorgate, E.C.2. (Tel: MONarch 6802; Telegrams: Verrolec, Avenue, London).

The New ca

A25

Definitely Different



ON VIEW AT THE
Ideal Home Exhibition
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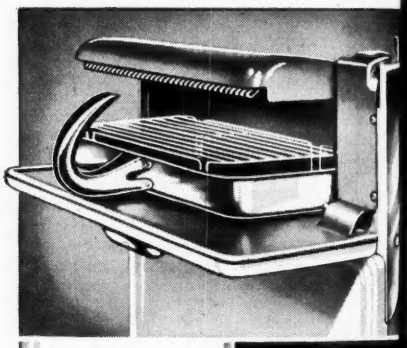
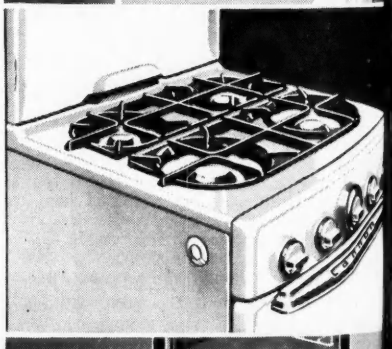
STAND No.58
GROUND FLOOR · GRAND HALL

Here at last is a definitely different and progressively new gas cooker, the result of many years of continuous experiment, market and cookery research. This is no mere re-styling, but a fundamental change in basic design — simple in conception, as are all good designs, and precipitating a host of far-reaching improvements.

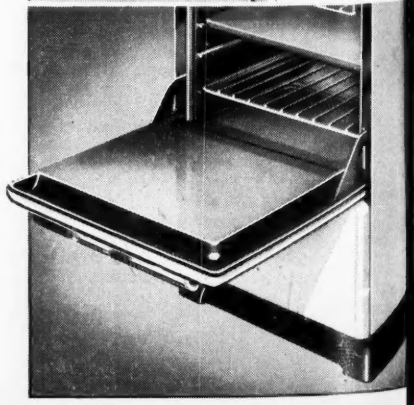
The focus is on grilling. The old badly-positioned virtually uncontrollable food-spoiler is replaced by an entirely new unit at eye-level, giving greater



Large capacity visual speed-griller (4 rounds of toast or 8 chops!) presents gleaming easy-clean enamel surfaces. You can watch your food cooking from the other side of the kitchen.



Large level hotplate with complete pan stability at any position. Two-part top bars for easy cleaning. Automatic press-button ignition.



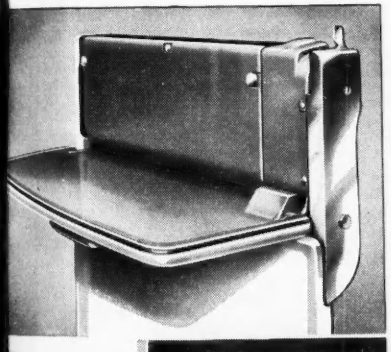
'Christmas turkey' oven at better working height, with drop door. Baffle plate (extra — on right) and flue-fitting thermostat permit oven sectioning and gas economy.

The New Cannon A25

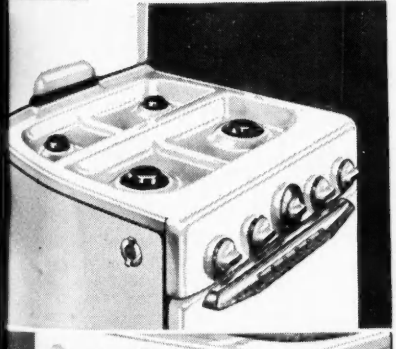
capacity, perfect visual control, and no unpleasant smells. This in turn makes possible a much larger oven at better working height, a broad level hotplate with closed-in base giving perfect overall pan stability, and a really capacious warming and storage chamber.

Combined with so much that is new and different is the fine Cannon workmanship and finish — and the experience of 125 years.

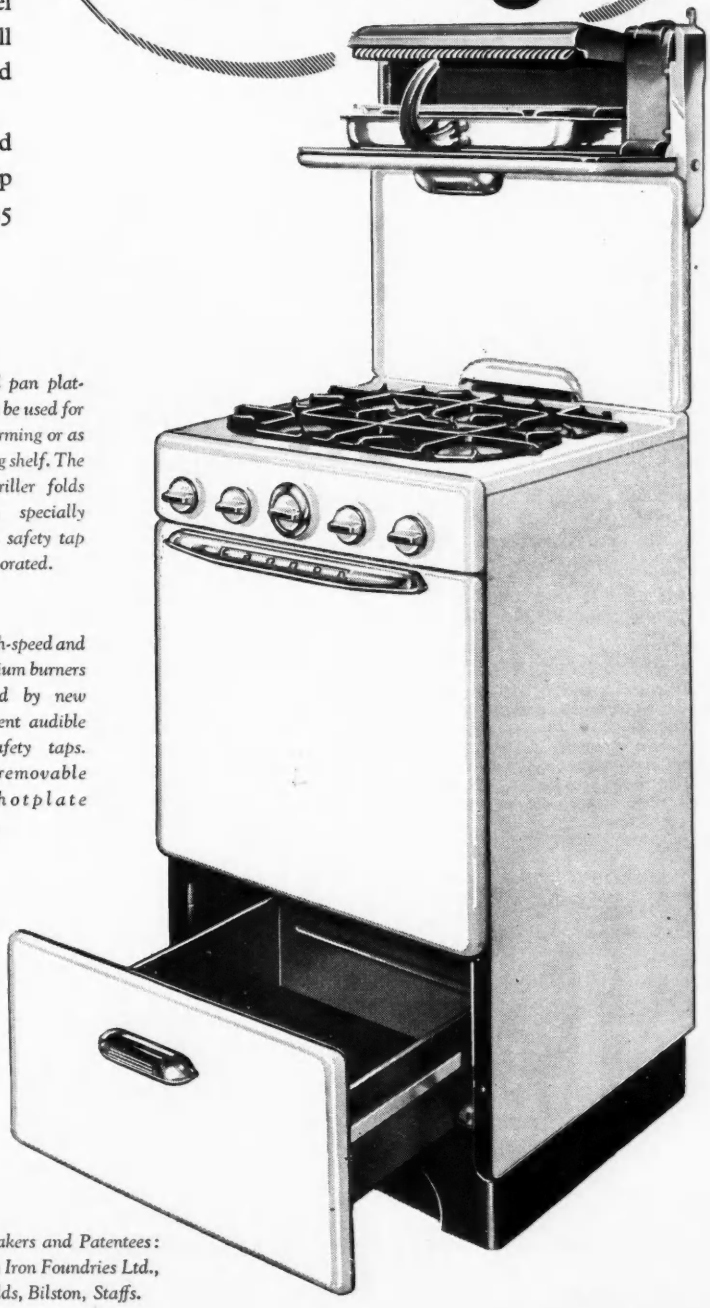
Focus on Grilling



The grill pan platform can be used for plate warming or as a working shelf. The whole griller folds flat. A specially designed safety tap is incorporated.



Two high-speed and two medium burners controlled by new type patent audible click safety taps. Easily removable solid hotplate sections.

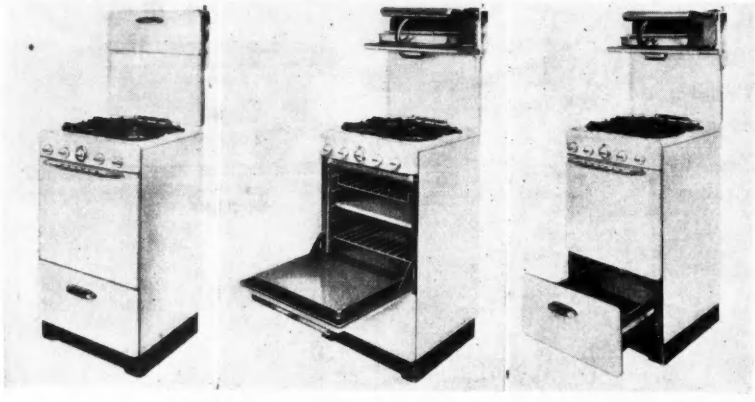


Sole Makers and Patentees: Cannon Iron Foundries Ltd., Deepfields, Bilston, Staffs.

TRADE NEWS

New Cannon Cooker

WE recently had the opportunity of inspecting a new domestic cooker —the A.125—now introduced to the market by Cannon Iron Foundries, Ltd., and we were impressed by its style, performance, and finish, and also by the original features which it embodies. It is likely, we think, to meet with wide favour.



The photograph on the left shows the Cannon A.125 cooker with the griller in its housing in the splash-plate. The neat and attractive lines of the cooker are apparent. The centre view shows the grill in position for use, the oven door being in the open position. On the right the warming chamber is seen extended.

The most outstanding feature of this new Cannon product is the grilling unit, which is at eye-level when in use and when not in use folds into a housing forming part of the splashplate. The appearance of the cooker in general and the grilling unit in particular can be seen from the photographs we reproduce. The unit provides visual cooking control and an alternative plate or working stand. The body of the griller unit consists of two pressure die cast members joined by a vitreous enamelled steel housing. The door and radiant panel are pivoted at their lower and upper edges and are interconnected so that the lowering of the door raises the radiant panel and *vice versa*. The tap is located at the top of the right hand side member and is of a special safety type. Gas is piped from the hotplate supply and controlled by the one governor. The grill pan, which is 8 in. wide and 16 in. long, is in aluminium for lightness and the handle is comfortable to hold and remains cool. The grill fret is 14 in. long and 6 in. wide.

In general the A.125 is robustly constructed of cast iron, sheet steel, and aluminium alloy frames. All visible parts and working surfaces are protected with acid-resisting vitreous enamel. The oven has a single back burner, lighted from the front by flash tube. The cake tray is unusually large, being 14 in. × 11½ in., and will take 20 scones or Queen cakes. Thermostatic control is by a newly designed liquid phial thermostat, the phial being located in the bottom flue where it is not visible. A channel in the back lining leads the products of combustion to hotplate level, where they are dispersed forward of the splash plate. The location of the thermostat phial enables the oven to be sectioned and thermostatically controlled in its reduced size. This gives economy in gas consumption. The space above the adjustable dome, which completely isolates the top section, can be brought into use as a warming chamber and, indeed, for certain cooking operations. The drop-down door is spring balanced and light to the touch, and the whole door may be removed without use of tools.

Below the oven is a storage drawer or warming chamber. This is constructed in pressed steel with vitreous enamelled front panel. It runs smoothly on roller bearings and can be removed for cleaning. A special grid sections the drawer and enables a half dinner service to be warmed.

The hotplate incorporates two high speed and two medium burners which are of dual construction and are interchangeable. Spill-over bowls are integral with the two sectioned hotplate surrounds The top bars are also in two sections and give overall pan stability. Ignition is by a newly designed press-button flash ignition which requires no battery or flint.

The following parts of the cooker are removable for cleaning:—

Hotplate.—Top bars, hotplate surround (in two light sections), boiling burners, and lighting device spider.

Oven.—Grids, burner, duct, baseplate. and flue cover.

Storage Drawer or Warming Chamber.—Completely detachable. The front plinth may also be removed for dusting underneath the cooker.

We give the following details regarding this new and outstanding domestic gas cooker:—

Overall Dimensions: Width, 21 in.; height with griller fitted, 57$\frac{5}{16}$ in.; height to hotplate, 36 in.; depth, 23$\frac{7}{8}$ in. (including griller unit).

Hotplate: Width, 21 in.; depth, 17¾ in. (extent of flat surface).

Oven: Width, 18 in.; height, 16¼ in.; depth, 16 in.

Gas Rates based on 500 C.V.:—

Griller burner, 28 cu. ft. per hour.

Large boiling burners, 25 cu. ft. per hour.

Medium boiling burners, 15 cu. ft. per hour.

Oven burner, 28 cu. ft. per hour.

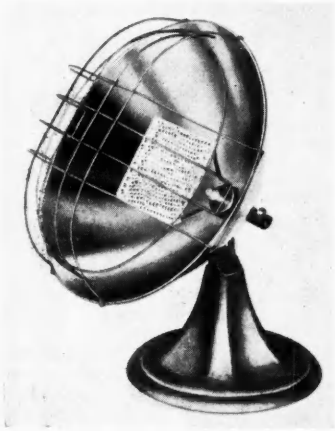
On the left can be seen the spill-over bowls of the hotplate. The centre shows the grilling unit in more detail, while on the right is a view of the working plate.

TRADE NEWS — Continued

Falk Stadelmann

Supplies of the new 'Briteglow' bowl heater are now available.

The outstanding feature of this portable heater is the use of treated knitted asbestos for the radiant. Combined with the chromium plated reflector which is a true parabola this element gives



superior direct radiation as well as brilliant reflection from every part of the bowl. Fitted with No. 2 size non-aerated jet the 'Briteglow' has a gas rate of 3,750 B.Th.U. per hour.

The large rounded base is finished in cream or green and the reflector can be moved over a wide angle. The dress guard conforms to the new B.S. specification. Details can be had on application from: *Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1.*

James Stott & Co.

An interesting range of hotcupboards manufactured by James Stott & Co. (Engineers), Ltd., is claimed to be the first series of hotcupboards made by any one firm to satisfy every purpose. The range comprises three models: the Colonial, the Empire, and the Imperial.

The Imperial, a heavy duty model, represents the standards of Stott's hotcupboards of recent years. New developments in a medium weight range are the Empire and Colonial.

The junior of the series, the Colonial, is of heavy gauge steel plate, the body being welded in one unit. It is fitted with two perforated shelves in japanned finish. The doors, as on all Stott hotcupboards, can be lifted out for inspection and run in stainless steel tracks.

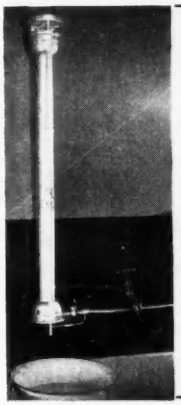
The gas model is heated by a single bar burner with non-aerated jets. A deflector plate fitted over the burner ensures even distribution of heat and continuous lighting of the whole rail. Heating is controlled by a chrome-plated thumb tap incorporating a pressure adjuster.

The gas type Colonial is finished in cream heat-resisting enamel, and can also be supplied with boiling table.—*James Stott & Co. (Engineers), Ltd., Vernon Works, Oldham.*

Fisher Governor Company

To meet the need for pneumatically operated valves for the control of liquids and gases under relatively low static pressures, the Fisher Governor Company, Ltd., has added a range of butterfly valves to the series of ported valves, pressure regulators, and other specialities for automatic control, now made by the company in England. Fisher butterfly valves are available in sizes from 4 in. to 24 in., and control the flow of fluid by a disc on a rotary shaft linked in a simple manner to a pneumatically operated diaphragm motor of the same type as used on Fisher ported valves. Standard diaphragm pressure range is 3 lb. to 15 lb. per sq. in., and for automatic pressure regulation the Fisher Wizard pilot can be mounted integral with the diaphragm casing.—*Fisher Governor Company, Ltd., Century Works, Lewisham, London, S.E.*13.

Volcano Heaters



The illustration shows the recently modified 'Volcano' water heater. It is manufactured by E. Bodley, 53, Museum St., High Holborn, London, W.C.1.

Babcock and Wilcox

The year 1951, so far as Babcock and Wilcox were concerned, maintained a high level of orders received and showed an encouraging increase in the output of their main factories which would have been even more encouraging had the steel supply position been easier. This increased output, however, together with the outstanding efforts of the Company's erecting and service departments has resulted in a larger number of boilers being commissioned—particularly for the B.E.A.—than in any previous year. By the end of the year, the evaporative capacity of Babcock boilers commissioned or on the eve of commissioning, aggregated some 11 mill. lb./hr. in Britain alone. Among these and the large volume of overseas orders are a number of units possessing special interest.

Orders were received from industries as widely diverse as oil refineries and bacon curing, including light and heavy engineering, several branches of the chemical industry, rubber, sugar refining, timber, gasworks, steelworks, and the plastics industry, and covered a 100-1 range of steaming capacities, the smallest unit being 4,000 lb./hr. and the largest 400,000 lb./hr. Coke breeze is the fuel for four 40,000 lb./hr. units installed at Beckton gasworks, operating at 500 lb./sq. in. 750°F., with chain grate stokers. Blast furnace gas and creosote pitch are alternative fuels for two other boilers at a steel works. The research organisation had a full programme, much of which was carried out in the new research station which was brought into full operation in 1951. Many coal and coke handling plants were installed embracing railway wagon tipplers, storing and reclaiming equipment, crushing and screening plant, automatic skip hoists, telphers, belt conveyors, chain-and-bucket elevators and gravity bucket conveyors, the latter arranged for automatic oil gun lubrication.

Trade Publications

We acknowledge with thanks the following:—

Saunders Valve Co., Ltd.—Informative booklet running to 28 pages dealing with Safran centrifugal pumps.

The Morgan Crucible Co., Ltd.—Leaflet on Triangle pure oxide tubes, crucibles, and furnace shapes.

Elliott Bros. (London), Ltd.—The second number of their Journal which is a technical review of developments in engineering and physical science.

Power Gas Corporation, Ltd.—Leaflet describing and illustrating the mechanical producers installed at the Nantgarw coke oven and by-product plant.

Electric and Musical Industries, Ltd.—Brochure containing report of 20th annual meeting and a pictorial record of the activities of the operating companies in the E.M.I. group.

Quasi-Arc Co., Ltd.—Technical circular giving details of the mechanical properties and chemical composition, welding technique, deposition and packing data, as well as the applications and characteristics of the electrode.

Pulsometer Engineering Co., Ltd.—Pamphlet describing one of the most recent water purification processes—the Ionomatic sodium silicate plant for removal of solid matter from heavily polluted water—made by the firm.

Jack Olding and Co., Ltd.—Beautifully produced brochure illustrating and describing the first heavy track-type tractor to be produced in England, manufactured by Vickers-Armstrong and powered by a Rolls Royce engine.

A new plant hire depôt covering portable air compressors, pneumatic tools, and pumps has been opened at Lichfield, Staffs., by *Saxton and Co. (London), Ltd., Spring Place, Kentish Town, London, N.W.5.*

In an adapted form the Radiovisor industrial smoke density indicator is applicable to grass and grain drying plants as a means of protection against contamination from fuel fumes. The Radiovisor Flamestat has been developed for use with town gas equipment. This unit cuts off the fuel supply should the burner flame be extinguished, and it is impossible for the fuel to be turned on until the lighting torch is actually in position against the burner.—*Radiovisor Parent, Ltd., 1, Stanhope Street, London, N.W.1.*

TRADE NEWS — Continued

Mercol Products

Mercol research resulted in a formula for a bituminous base coating for underground pipes. The formula is variable to suit the particular conditions of service under which a pipeline is operating, and the trade name 'Mercoloid' was given to the finished product. Further research was then devoted to finding the best means of applying 'Mercoloid' mechanically. Experiments were conducted on the theory that a pipe is a natural compression chamber or cylinder, and as such lends itself to the application of a viscous coating under piston pressure. It was recognised that underground pipes contain water or moisture which acts as an insulator against coating materials applied by ordinary methods.

Work proceeded on the basis that the water should be either removed, or neutralised, or made to perform a co-operative function in the method of coating. It was found that hydraulic pressure in the primary stages of application caused the water to act as a lubricant for the heavier bitumen, with the result that a wet pipe can be coated just as easily and efficiently as a dry pipe. A final 'overload' test, going well beyond the limit of conditions likely to be encountered, proved that a smooth, glass lined pipe, partially filled with water could be quickly and efficiently coated by this hydraulic method. The system is independent of steam, electricity, or compressed air facilities.

Sections of pipelines up to 300 yards in length can be 'Mercoloid' coated in a single operation, the actual length being governed by the length of pipe it is convenient to pre-clean—which factor is regulated by the position of valves, syphons, angles, etc. The process can be most economically employed where unbroken sections of the main of at least 50 yards long between junctions, acute angles, etc., can be isolated.

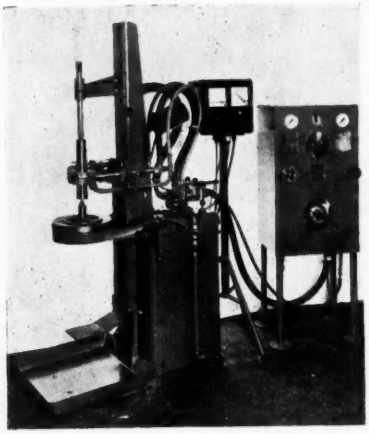
The basic principle of application lies in the keeping of a reservoir of 'Mercoloid' in high pressure contact with the walls of a pipe for a sufficient length of time to enable the compressed viscous material to expel all residual moisture and secure a positive grip on the walls of the pipe. The capacity of the reservoir is adjustable to suit the length and diameter of the pipe being cleaned.

Special equipment has been designed for the removal of naphthalene from gas mains.—*Mercol Products, Ltd., Eyre Lane, Sheffield 1. Tel. 25494, 27441.*

Alder and Mackay Ltd., have recently taken over a new factory on the Wythenshawe industrial estate at Sharston, where they will shortly go into full production. In transferring their Manchester works from Meadow Street, Moss Side, to a modern factory on the new estate, the firm is playing a part in providing more employment in Wythenshawe, and also reducing the travelling distance to work of their employees, half of whom already live on the Garden Estate.

Oxy-Town Gas Flame Hardening

WE recently attended a most interesting and convincing demonstration of the Peddinghaus oxy-town gas system of flame hardening introduced into this country by Surfard Limited for the surface hardening of steel. We believe we are right in saying that up to the present town gas has not been used in this country for this process since it was thought that oxy-town gas flames would not produce a sufficiently rapid heat input. However, by designing special burners, Peddinghaus have proved that ordinary town gas and oxygen give ample intensity for flame hardening. They have produced a comprehensive series of automatic machines to treat a wide variety of components, including gears of all sizes, crankshafts (seven bearings being treated



Peddinghaus vertical oxy-town gas hardening machine SH 81 showing Milliscope automatic temperature control and gas flow meter.

at once), rolls, wheels, locomotive and rolling stock parts, lathe beds, rails, press tools, pins, and many other parts subject to wear.

Unlike the processes of case hardening and nitriding, where carbon or nitrogen must be introduced into the steel by prolonged heat treatment in furnaces, flame hardening requires no change of composition, the steel used already containing, say, 0.35% to 0.7% carbon. The Peddinghaus process involves the rapid heating of the surface of the steel to the hardening temperature and quenching it before the heat has penetrated below the depth of hard case required.

Cast iron may also be surface hardened and items such as camshafts are successfully treated, the distortion being negligible.

Flame hardening by means of oxy-town gas affords considerable advantages in the production of hard surfaces where machine parts are subject to wear. The success of this speedy and economical system depends largely upon the accurate control of the temperature to which the surface of the steel is heated. If the hardening temperature were exceeded, grain coarsening of the case might occur and seriously affect its properties. In types of steel sensitive to hardening temperature, the over-heated layer might crack or even flake off when quenched.

Usually, a highly skilled and experienced operator has had to judge the temperature by the eye, but fatigue and changes in lighting conditions have sometimes led to errors and consequent scrapping of costly components. The heating of the steel is so rapid that the use of ordinary pyrometers is impracticable, owing to the slow response of direct indicating instruments or the time required to adjust the disappearing filament type.

Peddinghaus have recently introduced an automatic temperature control which entirely eliminates the human element. This instrument, the 'Milliscope,' is capable of responding to extremely rapid changes of temperature, and by using it in conjunction with the flame hardening machine precise control of hardening temperature is achieved.

The 'Milliscope' is set to the temperature required and as soon as this is reached a direct current is generated, this being utilised, in some cases, to control the speed of the burner travel, as in progressive hardening, and, in other cases to transfer the component being treated from the heating to the quenching position.

Even if the 'Milliscope' is not coupled to a flame hardening machine so as to make the process completely automatic, the instrument is invaluable to the operator, since it gives him warning of the approach of the critical temperature and then accurately indicates the moment at which it is reached.

The particular machine demonstrated to us is of the vertical type on which spindles and rolls of up to 5 in. in diameter and 24 in. long can be progressively hardened. The component is held between centres and rotated. Two semi-circular oxy-town gas burners, having a narrow slit which emits a ribbon of intense flame, are used for the heat input. These burners and the quenching jets situated below them are mounted on a carrier which is raised hydraulically throughout the length of the part to be hardened. On this carrier is mounted the 'working head' of the 'Milliscope,' which is sighted on the portion of the work being heated. In this way the 'Milliscope' follows the heated zone throughout the travel of the burner. Naturally, the faster the burners rise the lower the heat input to the component and *vice versa*. The speed at which the burners rise is capable of fine adjustment and is set slightly slow so that the tendency is for the temperature of the work to exceed the pre-set figure. Immediately this happens, however, the direct current generated by the 'Milliscope' causes a magnetic valve in the hydraulic system to permit more oil to pass to the cylinder, thus increasing the speed of the burner travel and thereby reducing the temperature. This results in a uniform degree and depth of hardness, concentricity being assured by the rotation of the component.

Alloy steels can now be replaced in many instances by straight carbon steels accurately hardened by this process.—*Surfard Limited, 101, Abbey House, 2, Victoria Street, London, S.W.1. Tel. Abbey 3565.*

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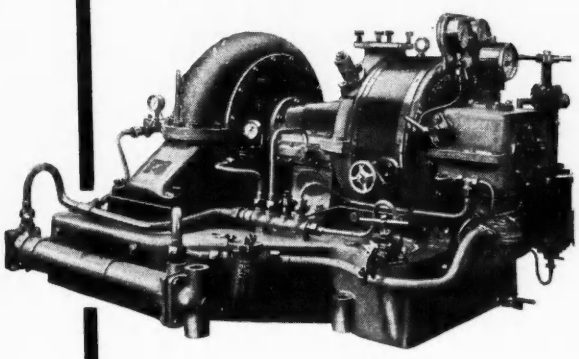

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